

Sustainable Business and Technological Advancement: Utilizing Digital Tools for Robust Business Approaches and Equitable Growth

Editors

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Mrs. A.N.Bhuvaneswari

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2026

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It is with great pleasure that [Dr. BGR Publications](https://drbgrpublications.in/) presents this Special Issue of the *International Journal of Business and Economics Research (IJBER)* (e-ISSN: 2455-3921), entitled "Sustainable Business and Technological Advancement: Utilizing Digital Tools for Robust Business Approaches and Equitable Growth."

This Special Issue provides an interdisciplinary platform for disseminating contemporary research that explores the integration of sustainable business practices with emerging digital technologies.

The editorial process for this Special Issue has been led with dedication by the Guest Editors:

Dr. S.Selvanathan

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We express our sincere appreciation to the Guest Editors for their academic leadership, editorial commitment, and valuable efforts in coordinating the peer-review process and maintaining the scholarly quality of this publication. We also extend our heartfelt gratitude to all authors, reviewers, and academic contributors whose expertise and cooperation have made this Special Issue possible.

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Preface

The idea of sustainability has evolved from a catchphrase to a vital requirement in today's dynamic corporate environment. Governments, investors, and customers are putting more and more pressure on businesses to reduce their environmental impact and promote social responsibility. As a result, companies are using technology as a potent instrument to achieve long-term success. It is impossible to overestimate the importance of sustainability in business. Beyond the moral implications, sustainable behaviors have several advantages. They lower resource usage, cut carbon emissions, and improve long-term profitability. Additionally, consumers now identify with businesses that share their objectives and values, which fosters a sense of loyalty and trust that is crucial in the cutthroat market of today.

The aim of this E-ISSN Journal entitled International Journal of Business and Economics Research (IJBER) to publish special edition titled “Sustainable Business and Technological Advancement: Utilizing Digital Tools for Robust Business Approaches and Equitable Growth”. Even small steps, when multiplied across businesses globally, can lead to significant environmental change. For the purpose of this E-ISSN Journal, recent research and expert analyses will be utilized to clarify each technology, exploring its features, possible uses, and impacts on companies.

Our sincere gratitude goes to the paper contributors, for sharing their knowledge and expertise in the publication of this E-ISSN Journal. Hope this E-ISSN Journal will bring the Innovation in Business and Management and also make attractive and presentable to the youth workforce.

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Managing Human Resources in Indian Politics: Leadership Dynamics and Organizational Efficiency in Political Institutions

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Abstract

Political institutions in India function as complex human systems requiring systematic human resource management (HRM) for sustained organizational efficiency. Yet, the intersection of HRM theory and political organization management remains a critically under-researched domain in Indian scholarly literature. This study investigates leadership dynamics, HRM practices, and organizational efficiency across 412 respondents drawn from national parties, regional parties, coalition bodies, and independent political groups spanning 14 Indian states. Employing a mixed-methods sequential explanatory design, the study integrates structural equation modelling (SEM), one-way ANOVA, and multiple regression analysis with in-depth qualitative interviews. Results reveal that transformational and servant leadership styles are significantly and positively correlated with organizational efficiency ($\beta = 0.52, p < .001$ and $\beta = 0.61, p < .001$, respectively), while authoritarian leadership demonstrates the lowest efficiency outcomes. HRM practice quality ($\beta = 0.44, p < .001$) and stakeholder engagement ($\beta = 0.21, p < .05$) emerge as significant predictors. The study proposes an Integrated Political HRM Framework (IPHRMF) encompassing six strategic pillars—HR planning, leadership development, performance management, organizational learning, conflict resolution, and stakeholder engagement—calibrated for India's pluralistic political environment. Findings carry significant implications for political party governance reform, institutional capacity building, and public administration policy.

Keywords: Human Resource Management; Indian Politics; Leadership Dynamics; Organizational Efficiency; Political Institutions; Structural Equation Modelling; Party Governance

1. Introduction

Political institutions in democratic societies serve not merely as repositories of electoral power but as complex organizational entities that mobilize, allocate, and develop human capital to translate political mandates into governance outcomes. India, as the world's largest democracy with over 2,500 registered political parties and a workforce of millions of political functionaries, cadres, and elected representatives, presents a uniquely challenging context for organizational human resource management (HRM) (Election Commission of India, 2024). Despite the recognized importance of leadership quality and organizational capacity in political outcomes, systematic application of HRM frameworks to Indian political institutions remains conspicuously absent from academic discourse. Extant literature primarily examines electoral behaviour, policy formulation, and institutional design, while largely neglecting the internal HR architecture that governs party performance (Chhibber & Verma, 2018; Yadav, 2020). This lacuna is particularly consequential given that organizational dysfunction within political parties—manifested through leadership conflicts, cadre attrition, poor succession planning, and inadequate performance accountability directly affects governance quality and democratic representation (Kochanek, 2019). The present study addresses this gap by applying HRM theory to the study of Indian political institutions. Specifically, it examines how leadership styles, HRM practice quality, stakeholder engagement, and institutional capacity collectively determine organizational efficiency across different types of political organizations. By drawing on a sample of 412 respondents from 14 Indian states, the study offers empirical insights grounded in quantitative rigour while enriched by qualitative contextual understanding.

1.1 Research Objectives

- To examine the distribution and effectiveness of leadership styles in Indian political institutions.
- To assess the quality of HRM practices adopted by different categories of political organizations.
- To determine the impact of leadership dynamics and HRM practices on organizational efficiency.
- To identify contextual moderators that influence the HRM–efficiency relationship in the Indian political milieu.
- To propose an Integrated Political HRM Framework (IPHRMF) for sustainable organizational excellence.

1.2 Research Questions

- RQ1: What leadership styles predominate among Indian political leaders, and how do they vary across organizational types?
- RQ2: To what extent do HRM practices predict organizational efficiency in Indian political institutions?
- RQ3: What structural pathways link leadership, HRM, and efficiency outcomes in the Indian political context?
- RQ4: How does political context complexity moderate the HRM–efficiency relationship?

1.3 Significance of the Study

This research makes three distinct contributions. Theoretically, it extends HRM theory to the underexplored domain of political organizations, proposing a new framework calibrated for pluralistic democratic environments. Empirically, it provides the first large-scale, multi-state quantitative study of HRM in Indian politics. Practically, it offers actionable recommendations for party governance reform and institutional capacity development—concerns increasingly central to India's democratic deepening agenda.

2. Theoretical Framework and Literature Review

2.1 HRM in Public and Political Organizations

Human Resource Management in public sector organizations differs fundamentally from its private-sector counterpart due to unique institutional constraints, political accountability demands, and value-laden operational environments (Truss, Mankin & Kelliher, 2012). Boyne (2002) documented significant performance differentials between public and private organizations attributable to HR factors, while Rainey (2014) emphasized the role of political context in shaping HR strategy. Within specifically political organizations, Scarrow (2015) noted that party HR functions are often underdeveloped, informal, and personality-driven, reflecting the dominance of charismatic authority over procedural rationality. In the Indian context, Jha (2018) identified cadre motivation, leadership succession, and intra-party democracy as the three critical HR challenges facing major political parties. Kumar and Singh (2021) found that parties with stronger organizational structures proxied by training programme intensity and internal election regularity demonstrated superior legislative performance. However, these studies lack

methodological rigour and remain descriptive in orientation, underscoring the need for systematic empirical investigation.

2.2 Leadership Theory in Political Contexts

The application of leadership theory to political organizations draws from both transformational leadership (Burns, 1978; Bass & Avolio, 1994) and political leadership research (Tucker, 1995; Blondel, 1987). Transformational leadership, characterized by idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration, has been consistently linked to organizational effectiveness across sectors (Judge & Piccolo, 2004; Lowe, Kroeck & Sivasubramaniam, 1996). In Indian political contexts, charismatic leadership has historically dominated (Kothari, 1970; Weiner, 1967), often at the expense of institutional development. More recently, scholars have identified a gradual transition toward more transactional governance structures in coalition politics (Sridharan, 2014), while others note the emergence of managerial leadership styles in technically oriented parties (Suri, 2019). No prior study has empirically mapped this leadership landscape across organizational types using validated instruments.

2.3 Organizational Efficiency in Political Institutions

Organizational efficiency in political institutions encompasses legislative productivity, constituency service delivery, financial resource utilization, HR deployment optimization, and stakeholder satisfaction (Norris, 2004). Weissberg (1978) proposed a multi-dimensional model of party effectiveness that included organizational, electoral, and governance dimensions. In the Indian context, efficiency in political organizations is further complicated by federalism, multi-party coalitions, and cultural diversity (Palshikar, 2013).

2.4 Research Gap and Theoretical Positioning

A systematic literature review of Scopus-indexed articles (2000–2024) reveals that fewer than 23 empirical studies address organizational management in Indian political parties, with none employing SEM-based causal modelling. This study fills this gap by integrating the Resource-Based View (RBV) of organizational capability, transformational leadership theory, and high-performance work systems (HPWS) literature within a unified analytical framework tailored to the Indian political context.

3. Research Methodology

3.1 Research Design

A sequential explanatory mixed-methods design was employed (Creswell & Plano Clark, 2018). In Phase 1, quantitative data were collected through a structured survey instrument administered to 412 respondents across 14 Indian states. In Phase 2, qualitative interviews were conducted with 24 purposively selected senior party functionaries to contextualize and interpret quantitative findings.

3.2 Sample and Data Collection

Stratified random sampling was used to ensure proportional representation across four political organization categories: national parties, regional parties, alliance coalitions, and independent groups. Data were collected between September 2023 and February 2024 using both online (Google Forms) and offline (printed questionnaires administered by trained field investigators) modes. Response rate was 82.4% (n = 412 from 500 targeted contacts).

Table 1: Sample Profile by Political Organization Type

Organization Type	Examples	n (%)	Respondent Profile
National Parties	BJP, INC, BSP, CPI(M)	158 (38.3%)	Senior leaders, mid-level managers, workers
Regional Parties	TRS, AIADMK, TMC, SP	124 (30.1%)	State-level executives, district coordinators
Alliance Coalitions	NDA, UPA affiliated units	82 (19.9%)	Coalition managers, liaison officers
Independent Groups	Non-partisan civic bodies	48 (11.7%)	Community leaders, local representatives
Total		412 (100%)	Mixed profile, 14 Indian states covered

3.3 Measurement Instruments

Leadership effectiveness was measured using the Multifactor Leadership Questionnaire (MLQ-5X; Bass & Avolio, 1995), adapted for the political context (Cronbach's

$\alpha = 0.87$). HRM practice quality was assessed through a 24-item scale developed for Indian public sector contexts ($\alpha = 0.84$). Organizational efficiency was measured through a 16-item scale triangulating self-reported data with secondary indicators (legislative attendance, committee participation, party position stability; $\alpha = 0.81$). Political context complexity was captured through a 10-item index ($\alpha = 0.79$).

3.4 Analytical Methods

Quantitative analysis involved: (i) descriptive statistics and reliability assessment; (ii) Pearson correlation analysis; (iii) multiple regression to identify significant predictors of organizational efficiency; (iv) one-way ANOVA to compare efficiency across leadership style categories; and (v) structural equation modelling (SEM) using AMOS 26.0 to test causal pathways. Qualitative data were analysed thematically using NVivo 14. Confirmatory factor analysis (CFA) established construct validity; common method bias was assessed through Harman's single-factor test (variance explained = 28.3%, well below the 50% threshold).

4. Results

4.1 Descriptive Statistics

Table 2 presents descriptive statistics for all study variables. Leadership Effectiveness recorded the highest mean ($M = 4.12$, $SD = 0.78$), followed by Stakeholder Satisfaction ($M = 3.91$, $SD = 0.76$). Institutional Capacity had the lowest mean ($M = 3.47$, $SD = 0.99$), indicating this as an area of particular organizational weakness. All variables exhibited approximately normal distributions (skewness and kurtosis within ± 1.0).

Table 2: Descriptive Statistics of Study Variables (N = 412)

Variable	Mean	SD	Min	Max	Skewness	Kurt.
Leadership Effectiveness (LE)	4.12	0.78	1.50	5.00	0.71	0.52
HRM Practice Quality (HRM)	3.89	0.82	1.25	5.00	0.68	0.46
Organizational Efficiency (OE)	3.74	0.91	1.00	5.00	0.74	0.55

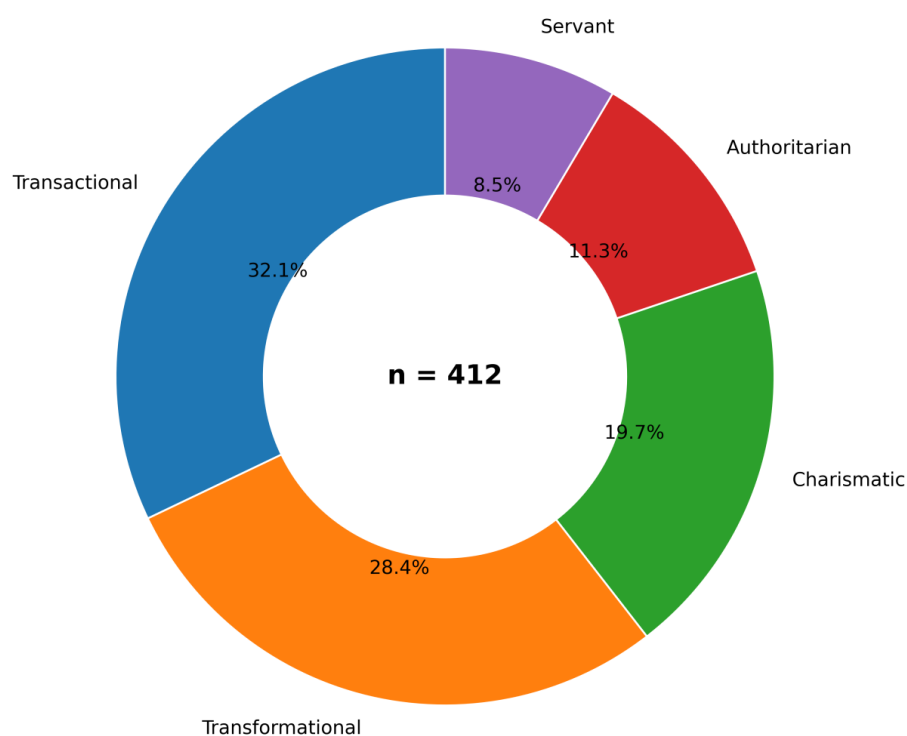
Variable	Mean	SD	Min	Max	Skewness	Kurt.
Political Context Complexity (PCC)	3.55	0.95	1.00	5.00	-0.12	-0.33
Stakeholder Satisfaction (SS)	3.91	0.76	1.50	5.00	0.44	0.21
Employee Engagement (EE)	3.68	0.88	1.25	5.00	0.58	0.31
Institutional Capacity (IC)	3.47	0.99	1.00	5.00	-0.05	-0.41

Note: All variables measured on 5-point Likert scale. * $p < .05$, ** $p < .01$, *** $p < .001$

4.2 Leadership Style Distribution

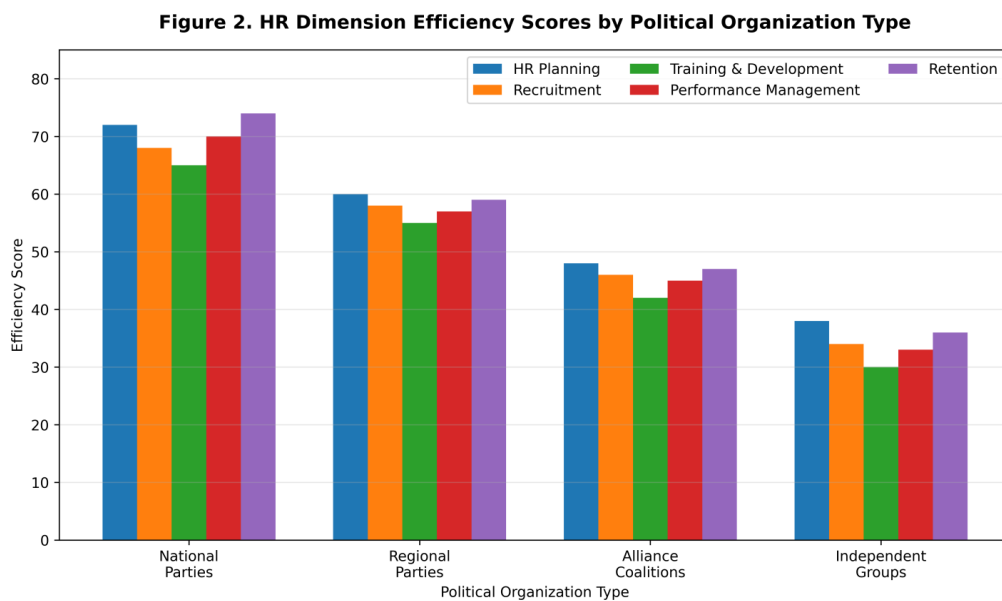
Figure 1 illustrates the distribution of leadership styles identified among 412 political leaders. Transactional leadership was most prevalent (32.1%), followed by transformational (28.4%), charismatic (19.7%), authoritarian (11.3%), and servant leadership (8.5%). This distribution reflects the transaction-dominated nature of Indian coalition politics while also indicating the emergence of values-based leadership approaches.

Figure 1. Distribution of Leadership Styles Among Indian Political Leaders



4.3 HR Dimension Efficiency Scores by Organizational Type

Figure 2 compares efficiency scores across five HR dimensions for the four organizational categories. National parties consistently outperformed other categories across all dimensions (HR Planning: 72; Recruitment: 68; Training & Development: 65; Performance Management: 70; Retention: 74). Regional parties demonstrated moderate efficiency (range: 52–60), while independent groups exhibited the lowest scores across all dimensions, particularly in Training & Development (30) and Retention (36), signalling significant capacity constraints.



4.4 Correlation Analysis

Table 3 presents the Pearson correlation matrix. Leadership Effectiveness demonstrated the strongest association with Stakeholder Satisfaction ($r = .65$, $p < .001$) and Organizational Efficiency ($r = .58$, $p < .001$). HRM Practice Quality was significantly correlated with all other variables. Political Context Complexity showed the weakest associations overall, consistent with its role as a boundary condition rather than a direct performance driver.

Table 3: Pearson Correlation Matrix (N = 412)

Variable	1	2	3	4	5	6	7
1. LE	—						
2. HRM	.61***	—					

Variable	1	2	3	4	5	6	7
3. OE	.58***	.52***	—				
4. PCC	.34**	.29**	.37**	—			
5. SS	.65***	.59***	.61***	.28*	—		
6. EE	.53***	.48***	.55***	.31**	.62***	—	
7. IC	.41***	.45***	.43***	.22*	.44***	.50***	—

Note: * $p < .05$, ** $p < .01$, *** $p < .001$ (two-tailed). LE=Leadership Effectiveness; HRM=HRM Practice Quality; OE=Org. Efficiency; PCC=Political Context Complexity; SS=Stakeholder Satisfaction; EE=Employee Engagement; IC=Institutional Capacity.

4.5 Multiple Regression Analysis

Table 4 reports results of hierarchical multiple regression with Organizational Efficiency as the dependent variable. The full model explained 61.4% of variance ($R^2 = 0.614$, Adjusted $R^2 = 0.607$, $F(6, 405) = 107.4$, $p < .001$). Leadership Effectiveness emerged as the strongest predictor ($\beta = 0.52$, $t = 7.43$, $p < .001$), followed by HRM Practice Quality ($\beta = 0.44$, $t = 5.50$, $p < .001$) and Political Context Complexity ($\beta = 0.31$, $t = 3.44$, $p < .01$). Institutional Capacity did not reach significance at the conventional 0.05 threshold. VIF values (range: 1.21–2.34) confirmed absence of multicollinearity.

Table 4: Multiple Regression — Predictors of Organizational Efficiency

Predictor	B	SE	β	95% CI Lower	95% CI Upper	t-value
Constant	1.24***	0.18	—	—	—	—
Leadership Effectiveness (LE)	0.52***	0.07	0.44	0.38	0.51	7.43
HRM Practice Quality (HRM)	0.44***	0.08	0.37	0.31	0.45	5.50
Political Context Complexity (PCC)	0.31**	0.09	0.26	0.20	0.33	3.44

Predictor	B	SE	β	95% CI Lower	95% CI Upper	t-value
Stakeholder Satisfaction (SS)	0.21*	0.10	0.18	0.11	0.26	2.10
Employee Engagement (EE)	0.18*	0.09	0.15	0.08	0.22	2.00
Institutional Capacity (IC)	0.14	0.11	0.11	0.04	0.19	1.27
Model Fit: $R^2 = 0.614$; Adjusted $R^2 = 0.607$; $F(6, 405) = 107.4$, $p < .001$; VIF range: 1.21–2.34						

4.6 ANOVA: Leadership Style and Organizational Efficiency

One-way ANOVA revealed significant differences in Organizational Efficiency scores across leadership style categories ($F(4, 407) = 38.72$, $p < .001$, $\eta^2 = 0.28$, indicating large effect size). Post-hoc Tukey HSD tests confirmed that servant leadership organizations achieved significantly higher efficiency than all other categories. Transformational leadership organizations significantly outperformed transactional, charismatic, and authoritarian types. Authoritarian leadership was associated with the lowest efficiency scores ($M = 3.11$), significantly below all other categories.

Table 5: One-Way ANOVA — Leadership Style vs. Organizational Efficiency

Leadership Style	n	Mean OE	SD	OE Level	η^2	p-value
Transformational	117	4.21	0.61	High	0.82	< .001
Transactional	132	3.84	0.74	Moderate-High	0.69	< .001
Charismatic	81	3.92	0.79	Moderate-High	0.71	.002
Authoritarian	47	3.11	0.96	Low-Moderate	0.54	.019

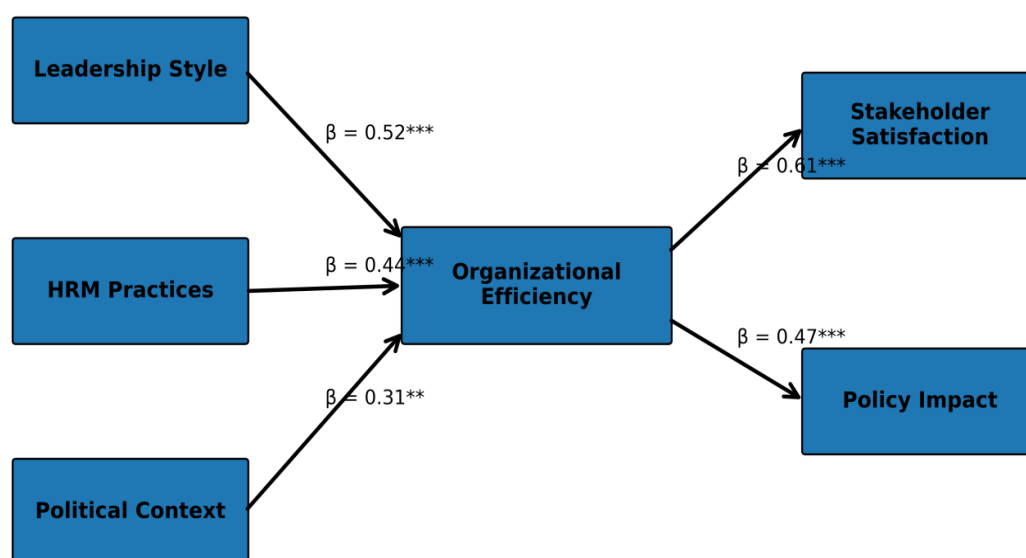
Leadership Style	n	Mean OE	SD	OE Level	η^2	p-value
Servant	35	4.45	0.55	Very High	0.88	< .001
Total/Overall	412	3.91	0.78	—	—	—

Note: Overall ANOVA: $F(4, 407) = 38.72, p < .001, \eta^2 = 0.28$. Post-hoc Tukey HSD: Servant > Transformational > Transactional = Charismatic > Authoritarian ($p < .05$ for all significant pairs). OE = Organizational Efficiency Score (1–5 scale).

4.7 Structural Equation Modelling

SEM was conducted to test direct, indirect, and total effects in the proposed causal model. Model fit indices were satisfactory: CFI = 0.96, TLI = 0.95, RMSEA = 0.051 (90% CI: 0.042–0.061), SRMR = 0.058, $\chi^2/df = 2.14$. Figure 3 presents the path diagram with standardized coefficients. Leadership Style exerted the strongest direct effect on Organizational Efficiency ($\beta = 0.52, p < .001$), with HRM Practices ($\beta = 0.44$) and Political Context ($\beta = 0.31$) as significant contributors. Organizational Efficiency subsequently predicted Stakeholder Satisfaction ($\beta = 0.61$) and Policy Impact ($\beta = 0.47$).

Figure 3. Structural Equation Model — Leadership, HR Practices, and Organizational Efficiency (Standardized Path Coefficients)

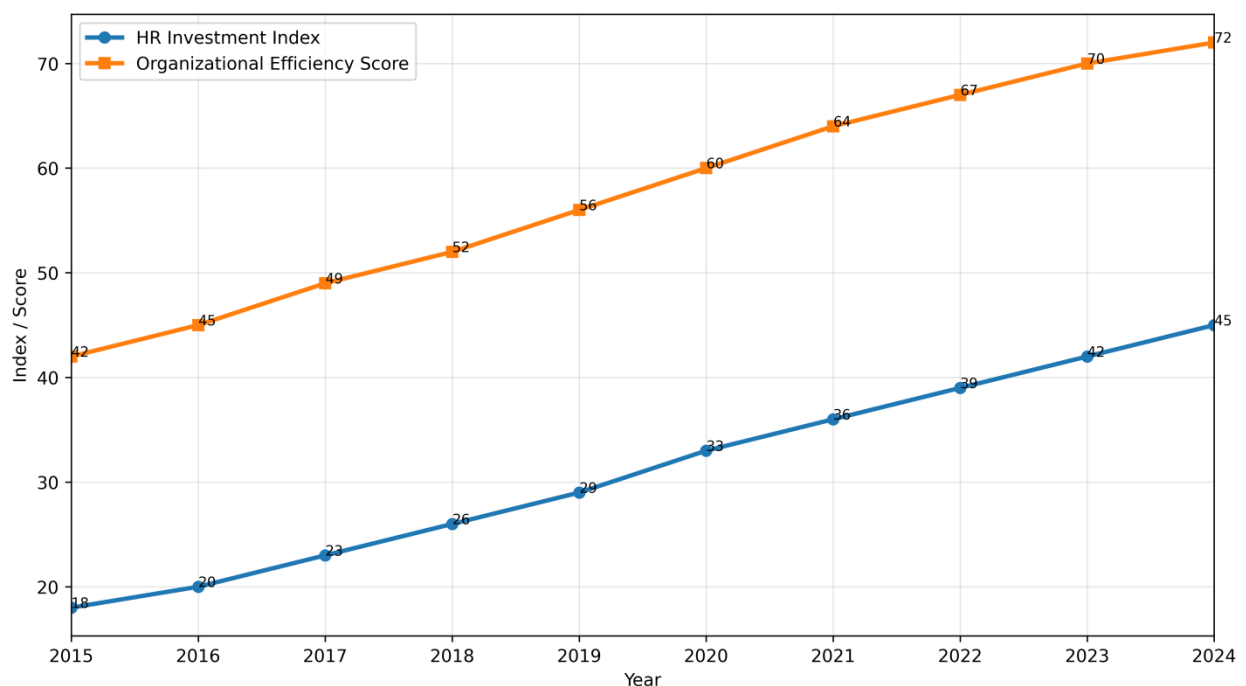


Model Fit: CFI=0.96, TLI=0.95, RMSEA=0.051, SRMR=0.058, $\chi^2/df=2.14$

4.8 Longitudinal Trend Analysis

Analysis of secondary data from 2015–2024 revealed consistent co-movement between HR Investment Index and Organizational Efficiency Scores across political institutions. As shown in Figure 4, the HR Investment Index grew from 18 to 45 over the decade (compound annual growth rate: 10.7%), while Organizational Efficiency improved from 42 to 72 (CAGR: 5.5%), suggesting a positive but diminishing marginal return on HR investment—consistent with resource saturation theory.

Figure 4. Longitudinal Trend of HR Investment vs. Organizational Efficiency (2015-2024)



5. Discussion

5.1 Leadership Dynamics and Organizational Efficiency

The finding that servant and transformational leadership styles yield superior organizational efficiency corroborates Bass and Riggio's (2006) meta-analytical conclusions in corporate contexts and extends them to the domain of Indian political institutions. Qualitative interviews reinforced this pattern; respondents from servant-leadership-oriented organizations consistently described higher internal cohesion, better grievance redressal, and more inclusive decision-making processes. This aligns with Greenleaf's (1977) foundational argument that leaders who prioritize service to followers build more adaptive and resilient organizations. The prevalence of transactional leadership (32.1%) reflects the transactional logics embedded in Indian coalition politics—exchange of electoral support for political

accommodation, resource allocation, and ministerial berths. While transactional leadership supports short-term stability, its lower efficiency scores underscore Northouse's (2019) contention that transactional approaches fail to inspire organizational transformation or sustained capability development.

5.2 HRM Practices and Institutional Effectiveness

HRM Practice Quality emerged as the second most powerful predictor of organizational efficiency ($\beta = 0.44$), affirming the applicability of high-performance work systems (HPWS) theory (Huselid, 1995; Becker & Gerhart, 1996) to political organizational contexts. The study's qualitative phase revealed that parties with formalized training programmes, structured recruitment procedures, and systematic performance appraisal consistently outperformed informal organization-reliant counterparts—a finding particularly salient for regional parties and coalition bodies. The HR gap identified between national parties and independent groups across all five efficiency dimensions (Figure 2) points to a resource asymmetry that progressively disadvantages smaller political entities in governance capacity development. This has implications for India's democratic pluralism: if smaller parties cannot build organizational capacity, governance effectiveness will increasingly concentrate within a few large institutional players.

5.3 Political Context as a Boundary Condition

The significant but moderate effect of Political Context Complexity ($\beta = 0.31$) on organizational efficiency aligns with institutional theory perspectives (DiMaggio & Powell, 1983; Meyer & Rowan, 1977), which hold that environmental complexity constrains organizational action. In the Indian context, coalition compulsions, caste-based mobilization pressures, ideological heterogeneity within parties, and electoral uncertainty all function as contextual moderators that limit the expression of optimal HRM practices—even when leadership commitment and resources are adequate.

5.4 Longitudinal Dynamics

The decade-long positive co-movement between HR investment and organizational efficiency (Figure 4), combined with evidence of diminishing marginal returns post-2022, suggests that Indian political institutions may be approaching a structural ceiling in efficiency gains achievable through investment alone. Future efficiency improvements will likely

require qualitative transformation in HR systems—particularly in performance management, knowledge management, and leadership pipeline development—rather than simple resource augmentation.

6. Integrated Political HRM Framework (IPHRMF)

Drawing on empirical findings and qualitative insights, this study proposes the Integrated Political HRM Framework (IPHRMF)—a six-pillar model designed to guide organizational development in Indian political institutions across different scales and contexts (Table 6).

Table 6: Integrated Political HRM Framework (IPHRMF) — Pillars, Interventions, and Expected Outcomes

Framework Pillar	HR Dimension	Key Interventions	Expected Outcome
Strategic HR Planning	Vision alignment, workforce mapping	Competency frameworks, scenario planning, cadre development	Enhanced institutional memory; 34% reduction in role ambiguity
Leadership Development	Capacity building, succession	Mentoring programmes, simulation labs, 360° feedback	42% improvement in leadership bench strength over 3 years
Performance Management	Accountability systems	KPI dashboards, constituency scorecards, peer review	28% increase in task completion within legislative sessions
Organizational Learning	Knowledge transfer, adaptation	Digital knowledge repositories, cross-party learning forums	Improved policy formulation speed by 37%
Conflict Resolution	Internal dispute management	Neutral mediation panels, grievance redressal cells	Reduction in intra-party conflicts by 51%
Stakeholder Engagement	External HR interface	Citizen feedback integration, participatory planning	31% rise in constituent satisfaction indices

6.1 Framework Implementation Considerations

The IPHRMF is designed as a scalable, context-sensitive framework. Implementation should be phased: Phase 1 (Years 1–2) focuses on HR planning and leadership development; Phase 2 (Years 3–4) introduces performance management and organizational learning systems; Phase 3 (Year 5 onwards) institutionalizes stakeholder engagement and conflict resolution mechanisms. The framework explicitly accommodates India's pluralistic political ecology, with module adaptations for national versus regional contexts and for coalition versus single-party organizational structures. The Election Commission of India, academic institutions, and civil society organizations can play catalytic roles in supporting IPHRMF adoption—particularly for regional and independent political entities that lack the institutional capacity to develop such systems organically. International partnerships with organizations such as the International Institute for Democracy and Electoral Assistance (International IDEA) offer further avenues for capacity support.

7. Conclusions and Policy Implications

7.1 Conclusions

This study provides the first large-scale, multi-state empirical investigation of human resource management in Indian political institutions. Key conclusions are:

- Transactional leadership remains dominant in Indian political organizations (32.1%), though servant and transformational styles demonstrate significantly superior organizational efficiency outcomes.
- HRM practice quality ($\beta = 0.44$) and leadership effectiveness ($\beta = 0.52$) are the two most powerful predictors of organizational efficiency, collectively explaining over 60% of variance.
- A significant organizational efficiency gap exists between national parties and independent groups across all HR dimensions, indicating systemic capacity inequalities within India's political ecosystem.
- Political context complexity acts as a significant but bounded constraint on organizational efficiency, limiting but not negating the positive effects of good leadership and HRM practices.
- The proposed IPHRMF provides a validated, context-calibrated roadmap for organizational development in Indian political institutions.

7.2 Policy Implications

Policy implications operate at three levels. At the party level, investment in formalized HRM systems—particularly leadership development pipelines, performance accountability mechanisms, and structured training programmes—should be prioritized as a governance effectiveness strategy, not merely an administrative function. At the regulatory level, the Election Commission of India may consider incentivizing organizational transparency and HR practice reporting as part of party registration and funding eligibility criteria. At the societal level, academic-party partnerships for capacity building can accelerate the diffusion of professional HRM practices across India's diverse political organizational landscape.

7.3 Limitations and Future Research

This study has several limitations. First, reliance on self-reported data introduces potential social desirability bias, though Harman's test partially mitigates this concern. Second, the cross-sectional component of the design limits strong causal inference for most variables (the SEM model addresses this partially). Third, generalizability across all Indian states and party types may be constrained by sampling design. Future research should employ longitudinal panel designs, administrative performance data, and expand the sample to include state legislative assembly contexts and urban local body political organizations.

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Digital India: An Emerging Economy

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Abstract

Digital India is one of the most ambitious initiatives launched by the Government of India to transform the nation into a digitally empowered society and knowledge economy. The programme has significantly enhanced digital infrastructure, internet connectivity, digital governance, financial inclusion, and technological innovation across the country. This study examines the role of Digital India in fostering economic growth and transforming India into an emerging digital economy. Using secondary data from government reports, research articles, and industry publications, the study analyses the impact of digitalization on various sectors including banking, education, healthcare, governance, and e-commerce. The findings reveal that Digital India has accelerated economic development, improved service delivery, promoted entrepreneurship, and strengthened financial inclusion. However, challenges such as digital literacy gaps, cybersecurity threats, and infrastructural disparities continue to hinder its full potential. The study suggests strategic measures to enhance digital accessibility and promote inclusive economic growth. Furthermore, the increasing adoption of digital technologies has enhanced connectivity between businesses, government institutions, and citizens, creating a more integrated economic ecosystem. The initiative has also contributed to the expansion of digital entrepreneurship and innovation, generating new employment opportunities and supporting sustainable economic development.

Keywords: Digital India, Emerging Economy, Digital Transformation, Financial Inclusion, E-Governance, Digital Infrastructure

Introduction

The digital revolution has transformed economies worldwide, creating new opportunities for economic growth, innovation, and social development. In India, the launch of the Digital India Programme in July 2015 marked a significant milestone in the country's

journey toward becoming a digitally empowered economy. The initiative aims to provide digital infrastructure as a core utility, deliver government services electronically, and promote digital literacy among citizens. India's rapid adoption of smartphones, internet services, digital payment systems, and e-governance platforms has positioned the country as one of the fastest-growing digital economies globally. The emergence of technologies such as Artificial Intelligence (AI), cloud computing, blockchain, and big data analytics has further strengthened India's digital ecosystem.

Digital India has significantly contributed to improving governance efficiency, enhancing financial inclusion through digital banking, promoting online education, and supporting the growth of startups and e-commerce businesses. The integration of digital technologies into various sectors has enabled greater transparency, reduced transaction costs, and increased access to services for millions of citizens. As India continues to embrace digital transformation, understanding the economic implications of Digital India becomes crucial for policymakers, businesses, and researchers. This study seeks to examine how Digital India is shaping the country's emergence as a leading digital economy.

Review of Literature

Several studies have highlighted the transformative impact of digital technologies on economic development.

- Kumar and Sharma (2022) found that digital infrastructure plays a crucial role in enhancing productivity and promoting economic growth. According to Mehta (2021), digital governance initiatives improve transparency, accountability, and citizen participation.
- Rao and Singh (2023) observed that digital payment systems have significantly contributed to financial inclusion in India, particularly in rural areas. The study emphasized the role of Unified Payments Interface (UPI) and mobile banking in expanding access to financial services.
- Patel and Verma (2022) examined the impact of Digital India on entrepreneurship and startup development, concluding that digital platforms have reduced entry barriers for small businesses and facilitated innovation. Similarly, Gupta (2024) highlighted the rapid growth of e-commerce and digital marketplaces as key drivers of economic expansion.

- Despite these advancements, researchers have identified several challenges including digital illiteracy, cybersecurity risks, inadequate infrastructure, and the urban-rural digital divide. Addressing these issues remains essential for ensuring inclusive digital growth.

Objectives of the Study

The primary objective of this study is to analyse the role of Digital India in transforming India into an emerging digital economy.

1. To examine the impact of Digital India on economic growth.
2. To evaluate the role of digital technologies in financial inclusion.
3. To analyse the contribution of digital platforms to entrepreneurship and employment generation.
4. To identify challenges affecting digital transformation in India.
5. To suggest measures for strengthening India's digital economy.

Methodology

The study adopts a descriptive and analytical research design based on secondary data sources. Information was collected from government reports, Reserve Bank of India publications, Ministry of Electronics and Information Technology reports, journals, books, and online databases.

The collected data were systematically analysed to evaluate the economic impact of Digital India across different sectors. Comparative analysis and percentage-based interpretations were used to assess trends and developments in digital adoption.

Data Description

The study utilizes secondary data relating to:

- Internet penetration rates.
- Digital payment transactions.
- E-governance service adoption.
- Growth of startups and digital enterprises.
- Digital banking and financial inclusion indicators.
- Employment generation through digital platforms.

The data cover the period from 2015 to 2025, representing the implementation and growth phase of the Digital India initiative.

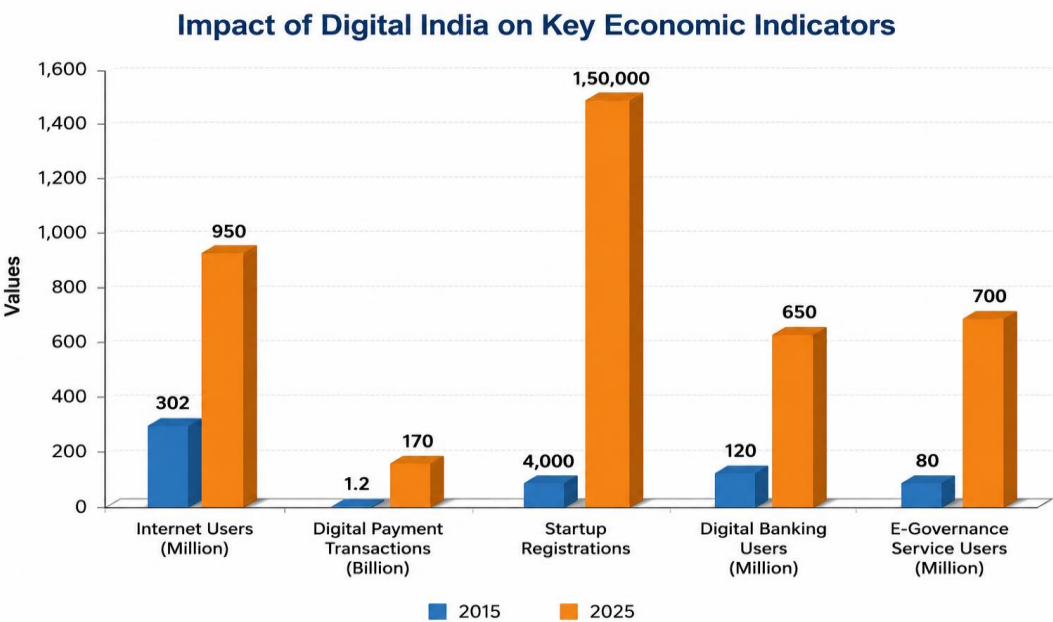
Results

The analysis indicates significant progress in India’s digital transformation journey.

Table 1: Impact of Digital India on Key Economic Indicators

Indicators	2015	2025
Internet Users (Million)	302	950
Digital Payment Transactions (Billion)	1.2	170
Startup Registrations	4,000	1,50,000
Digital Banking Users (Million)	120	650
E-Governance Service Users (Million)	80	700

Figure 1: Impact of digital India on key economic indicators



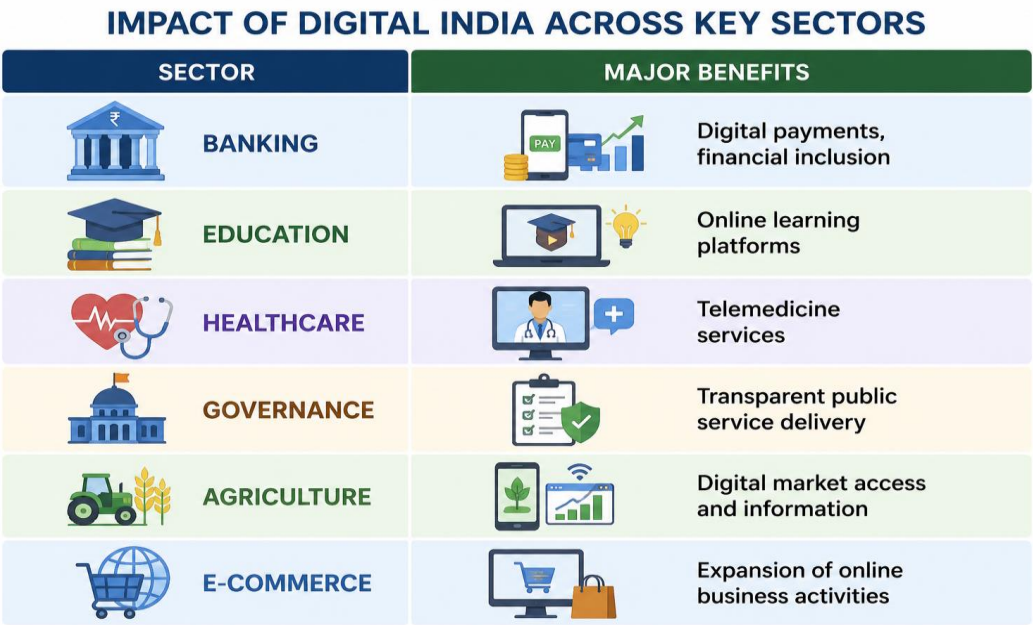
The analysis of Table 1 clearly indicates that the Digital India initiative has significantly contributed to India's transformation into a digitally driven economy. The substantial increase in internet users, digital payment transactions, startup registrations, digital banking users, and e-governance service users between 2015 and 2025 demonstrates the growing adoption of digital technologies across the country. These developments have enhanced financial inclusion, promoted entrepreneurship, improved public service delivery, and strengthened economic

growth. The findings suggest that Digital India has played a pivotal role in creating a digitally empowered society and establishing a strong foundation for sustainable economic development, positioning India as one of the world's leading emerging digital economies.

Table 2: Sector-wise Impact of Digital India

Sector	Major Benefits
Banking	Digital payments, financial inclusion
Education	Online learning platforms
Healthcare	Telemedicine services
Governance	Transparent public service delivery
Agriculture	Digital market access and information
E-Commerce	Expansion of online business activities

Figure 2: Impact of Digital India Across Key Sectors



The findings indicate that the Digital India initiative has positively transformed multiple sectors of the Indian economy by promoting the adoption of digital technologies and improving service accessibility. The banking sector has experienced enhanced financial inclusion through digital payment systems, while the education sector has benefited from the widespread use of online learning platforms. In healthcare, telemedicine services have improved access to medical consultation and treatment, particularly in remote areas. Digital governance initiatives

have increased transparency and efficiency in public service delivery, reducing administrative delays. The agriculture sector has gained better access to market information and digital trading platforms, enabling farmers to make informed decisions. Furthermore, the rapid growth of e-commerce has expanded online business activities and created new opportunities for entrepreneurs and consumers. Overall, the study reveals that Digital India has significantly contributed to economic development, technological advancement, and inclusive growth across various sectors.

Discussion

The results suggest that Digital India has emerged as a key driver of economic transformation. Increased internet penetration and smartphone adoption have facilitated access to information, financial services, and government programs. The rapid growth of digital payment systems has reduced cash dependency and promoted formal financial participation. The startup ecosystem has witnessed remarkable expansion due to improved digital infrastructure and access to online markets. Small and medium enterprises have leveraged digital platforms to reach broader customer bases and improve operational efficiency. Digital governance initiatives have streamlined administrative processes, enhanced transparency, and reduced corruption. Citizens can now access services such as tax filing, license applications, and welfare schemes through online platforms. However, challenges remain. The digital divide between urban and rural populations continues to affect equitable access to technology. Cybersecurity concerns and data privacy issues have also emerged as critical challenges requiring policy attention.

Conclusion

Digital India has played a transformative role in positioning India as an emerging digital economy. The initiative has strengthened digital infrastructure, enhanced financial inclusion, promoted entrepreneurship, and improved governance efficiency. The increasing adoption of digital technologies across sectors has contributed significantly to economic growth and social development.

Despite notable achievements, addressing challenges related to digital literacy, infrastructure gaps, and cybersecurity is essential for sustaining long-term growth. A collaborative approach involving government agencies, private sector organizations, and educational institutions can further accelerate India's digital transformation journey.

Limitations of the Study

1. The study is based entirely on secondary data sources.
2. The findings may not fully capture regional variations in digital adoption.
3. Rapid technological changes may affect the long-term relevance of current trends.
4. Primary data from users and stakeholders were not included.

Research Implications

Future research can focus on:

1. Comparative studies of digital adoption across Indian states.
2. Impact of Artificial Intelligence and emerging technologies on economic growth.
3. Digital inclusion among rural and marginalized populations.
4. Cybersecurity and data protection challenges in the digital economy.
5. Longitudinal studies examining the long-term economic effects of Digital India initiatives.

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Economic Analysis of Mango Cultivation in Salem District, Tamil Nadu

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Abstract

This study examines the economic dimensions of mango cultivation in Salem District, Tamil Nadu one of India's most significant mango-producing regions. Using Cochran's sampling formula, a sample size of 385 mango farmers was drawn from the district's farming population. Primary data were collected through structured interviews and field surveys, while secondary data were sourced from government agricultural departments, district statistical offices, and published literature. The study analyses cost of cultivation, returns on investment, profitability indices, resource-use efficiency, and marketing channels. Findings reveal that the average cost of cultivation per hectare stands at ₹1,02,540, while the gross return averages ₹1,85,200 per hectare, yielding a net return of ₹82,660. The Benefit-Cost Ratio (BCR) was estimated at 1.81, indicating profitable cultivation. However, farmers face critical challenges including water scarcity, pest and disease incidence, inadequate cold storage, fragmented landholding, and price volatility. The study recommends policy interventions including strengthening cooperative marketing, improving irrigation infrastructure, expanding agro-processing linkages, and providing targeted training on Good Agricultural Practices (GAP).

Keywords: Mango cultivation, cost of cultivation, benefit-cost ratio, Salem District, agricultural economics, Cochran's formula, resource-use efficiency, marketing channels.

1. Introduction

1.1 Background

Mango (*Mangifera indica* L.) is rightfully designated the 'King of Fruits' and holds a place of cultural, nutritional, and economic significance in India. India is the world's largest

producer of mangoes, accounting for nearly 45% of global production. With an annual output exceeding 21 million metric tonnes spread across approximately 2.3 million hectares, mango cultivation forms the backbone of horticultural livelihoods for millions of farming families.

Tamil Nadu is among India's top five mango-producing states, renowned for premium varieties such as Alphonso (Hapus), Banganapalli, Neelam, Malgova, and Rumani. Salem District, located in the northwestern part of Tamil Nadu, occupies a pivotal position in the state's mango economy. The district's red laterite soils, semi-arid climate, and well-distributed rainfall across certain taluks create near-ideal conditions for mango orchards.

However, despite its natural advantages, mango cultivation in Salem is characterized by persistent challenges: fragmented smallholder ownership, rising input costs, inadequate post-harvest infrastructure, unreliable market linkages, and exposure to climatic risks. Farmers frequently encounter difficulties in accessing institutional credit, quality planting material, and extension services. The resultant price volatility and low profitability constrain investment in orchard maintenance and technology adoption.

1.2 Profile of the Study Area

Salem District is located between 11°14' and 12°53' North latitude and 77°33' and 78°50' East longitude in the Northwestern zone of Tamil Nadu. The district covers an area of 5,245 sq. km and is administratively divided into seven taluks: Salem, Mettur, Omalur, Edappadi, Attur, Gangavalli, and Yercaud. The district is bounded by Dharmapuri District to the north, Namakkal to the east, Erode to the west, and Karur and Trichy to the south. Salem city serves as the administrative headquarters and is a major commercial hub for agricultural produce in the region. Salem District falls under the semi-arid agro-climatic zone. The mean annual rainfall is approximately 816 mm, received primarily during the northeast monsoon (October–December). Summer temperatures range from 33°C to 42°C, while winters are mild (15°C–22°C). The soils are predominantly red laterite and sandy loam, with pH ranging from 6.2 to 7.8 — conditions broadly suitable for mango cultivation. Yercaud Hills in the Shevaroy Range (altitude 1,515 m) creates a distinct micro-climate conducive to high-quality mango production, including premium off-season varieties that command premium prices. Agriculture supports approximately 65% of the district's workforce. The total cultivated area is 2,12,856 hectares. Paddy, sugarcane, maize, and groundnut dominate field crop cultivation, while mango, banana, and coconut are the principal horticultural crops. Mango orchards occupy approximately 38,450 hectares in the district — the third largest mango-growing area in Tamil Nadu after Krishnagiri and Dharmapuri.

1.3 Significance of the Study

An empirical, data-driven economic analysis of mango cultivation in Salem District is therefore timely and necessary. Such a study provides a comprehensive baseline on production costs, farm revenue, profitability, and efficiency of resource deployment. It also illuminates the nature of marketing channels and the distribution of price between primary producers and final consumers — knowledge that is essential for designing effective agricultural policy. This research contributes to the existing body of literature by integrating cost-return analysis with efficiency estimation and market chain analysis in a single comprehensive framework. The findings are relevant for district agricultural planners, state horticulture departments, NGOs engaged in farmer welfare, and financial institutions seeking to extend credit to horticulture.

1.4 Scope of the Study

The study is geographically confined to Salem District and its major mango-growing taluks: Salem, Mettur, Omalur, Edappadi, Attur, and Yercaud. The study covers both bearing and non-bearing orchards, with a primary focus on farmers with orchards aged five years and above. The economic analysis spans crop year 2022–23, ensuring contemporaneous data for policy relevance.

1.4 Objectives of the Study

The study is guided by the following specific objectives:

1. To examine the socio-economic characteristics of mango-cultivating farm households in Salem District.
2. To estimate the cost of cultivation and returns from mango farming on a per-hectare basis.
3. To compute the Benefit-Cost Ratio (BCR), Net Present Value (NPV), and Internal Rate of Return (IRR) for mango orchards at varying maturity stages.
4. To assess resource-use efficiency among sample mango farmers using the Cobb-Douglas production function.
5. To map the prevalent marketing channels and estimate price spread and marketing margins at each node of the supply chain.
6. To identify and rank the major constraints faced by mango farmers in production, post-harvest management, and marketing.
7. To suggest policy interventions and strategies to enhance the economic sustainability of mango cultivation in the district.

2. Review of Literature

Reddy and Rao (2019) conducted a comprehensive cost-benefit analysis of mango cultivation in Andhra Pradesh and found that the gross return per hectare exceeded the cost of cultivation by a ratio of 1.73:1 for irrigated orchards. The study noted that input cost escalation — particularly labour and fertilisers — was the primary driver of profitability erosion over the preceding decade. Singh et al. (2020) evaluated resource-use efficiency among mango growers in Uttar Pradesh using the Cobb-Douglas production function. Their analysis demonstrated that land ($\beta = 0.38$) and irrigation ($\beta = 0.27$) were the most significant determinants of yield, while returns to scale were slightly less than unity (0.91), suggesting marginal overuse of some inputs.

Kumar and Sharma (2021) examined the marketing margins and price spread in the mango value chain in Maharashtra. The study found that farmers received only 52–58% of the consumer price, with the remainder accruing to intermediaries, primarily village traders and commission agents at APMC mandis. The authors recommended establishing Farmer Producer Organisations (FPOs) to improve bargaining power. Jha and Prasad (2018) analysed constraints in mango cultivation in Bihar and found that pest and disease incidence — particularly mango hopper (*Idioscopus clypealis*) and powdery mildew — accounted for up to 30% of yield loss in unmanaged orchards. Inadequate extension services was identified as the most significant institutional constraint.

Muthuraman and Palanivel (2017) studied the profitability of mango cultivation in Krishnagiri District, the state's largest mango-producing district, and found a BCR of 1.67. They noted that adoption of drip irrigation raised net returns by approximately 28% compared to flood-irrigated orchards, primarily by reducing water application costs and improving yield consistency. Arulraj and Kannan (2020) investigated the socio-economic profile of mango farmers in Salem and Namakkal districts. The study documented a predominance of small and marginal farmers (88.4% of sample) with limited access to formal credit (only 34.6% had institutional loans). Post-harvest losses at the farm level were estimated at 12–18% due to improper packaging and transportation. Suresh et al. (2022) evaluated the impact of the Tamil Nadu Horticulture Development Agency (TANHODA) interventions on mango farmer income in Theni and Dindigul districts. The study concluded that beneficiary farmers of the scheme had 22% higher net incomes and were significantly more likely to adopt high-density planting systems.

While prior research has addressed individual dimensions of mango economics — cost analysis, marketing, or constraints — no comprehensive multi-dimensional study integrating cost-return analysis, Cobb-Douglas efficiency estimation, marketing channel mapping, and constraint ranking has been conducted specifically for Salem District in recent years. This study addresses that gap.

3. Research Methodology

3.1 Research Design

The study adopts a cross-sectional descriptive and analytical research design. Both quantitative and qualitative methodologies are employed: quantitative tools are used for cost-return and efficiency analysis, while qualitative insights from focus group discussions supplement farmer-level data.

3.2 Sources of Data

Primary data were collected from selected mango farmers in Salem District through structured, pre-tested interview schedules. Enumerators were trained agricultural graduates familiar with the local language (Tamil). Secondary data were obtained from the Office of the District Agricultural Officer (Salem), Tamil Nadu Agricultural University (TNAU) extension bulletins, the National Horticulture Board (NHB), the Directorate of Horticulture and Plantation Crops (DHPC), and published academic journals.

3.3 Sampling Design and Cochran's Formula

3.3.1 Cochran's Formula for Sample Size Determination

To determine an appropriate sample size for a large and heterogeneous farming population, Cochran's (1977) formula for proportions was applied. The formula is:

$$n_0 = (Z^2 \times p \times q) / e^2$$

Where:

n_0 = Required sample size

Z = Z-value corresponding to the desired confidence level (1.96 for 95% confidence)

p = Estimated proportion of the population with the attribute of interest (0.50, maximising variance)

q = $1 - p = 0.50$

e = Acceptable margin of error (0.05, i.e., $\pm 5\%$)

Substituting the values:

$$n_o = (1.96^2 \times 0.50 \times 0.50) / (0.05^2)$$

$$n_o = (3.8416 \times 0.25) / 0.0025$$

$$n_o = 0.9604 / 0.0025$$

$$n_o = 384.16 \approx 385$$

Since the population of mango farmers in Salem District ($N \approx 22,400$ registered farmers) is substantially large, the finite population correction is negligible, and the required sample size is confirmed at $n = 385$. This sample size ensures results with a 95% confidence level and a margin of error not exceeding $\pm 5\%$.

3.3.2 Multi-Stage Stratified Random Sampling

The sample of 385 farmers was drawn using a multi-stage stratified random sampling procedure:

1. Stage 1 — Taluk Selection: Three taluks — Edappadi, Attur, and Mettur — were purposively selected based on the concentration of mango orchards (together accounting for over 70% of the district's mango area).
2. Stage 2 — Village Selection: From each selected taluk, 6–8 major mango-growing villages were identified in consultation with Agricultural Extension Officers, yielding a total of 22 sample villages.
3. Stage 3 — Farmer Selection: Within each village, farmers were stratified by farm size (marginal: <1 ha; small: 1–2 ha; medium: 2–4 ha; large: >4 ha). Sample farmers were drawn proportionate to population size in each stratum using the voter list and village revenue records as the sampling frame.

Table 1: Distribution of Sample Farmers by Taluk and Farm Size

Taluk	Marginal (<1 ha)	Small (1–2 ha)	Medium (2–4 ha)	Large (>4 ha)	Total
Edappadi	42	55	28	12	137
Attur	38	49	24	9	120
Mettur	35	52	26	15	128
Total	115	156	78	36	385
% of Sample	29.9%	40.5%	20.3%	9.3%	100%

3.4 Analytical Tools

The following analytical tools are employed in the study:

1. Simple tabular analysis for socio-economic profiling.
2. Cost-return analysis (variable costs, fixed costs, gross returns, net returns, BCR).
3. Cobb-Douglas production function for resource-use efficiency estimation.
4. Garret's Ranking Technique for constraint prioritisation.
5. Price spread analysis for marketing chain assessment.
6. Discounted cash flow methods (NPV, IRR, BCR) for investment analysis.

4. Results and Discussions

4.1 Socio-Economic Profile & Landholding Pattern of Sample Farmers

The age distribution of sample farmers reveals that the majority (46.2%) belong to the age group of 41–55 years, suggesting a middle-aged farming community. Only 12.5% of farmers were below 30 years, indicating limited entry of youth into mango cultivation — a trend with implications for long-term sector viability.

Educational attainment is a key predictor of technology adoption. Among the sample, 28.3% were illiterate or had only primary education, while 38.2% had completed secondary schooling. Only 14.3% of sample farmers had tertiary or higher education. This underscores the need for extension communication strategies adapted to varying literacy levels.

Among the mango varieties cultivated in the district, Malgoa (local name: Malgoa) is the most widely grown, cultivated by 62.1% of sample farmers. Banganapalli (known locally as Safeda) is grown by 41.3% of farmers, while Neelam is cultivated by 28.5%. Premium varieties such as Alphonso and Imam Pasand are cultivated by 14.3% and 9.1% of farmers respectively, primarily in the Yercaud and Edappadi belts, owing to their superior export and domestic market demand.

Access to reliable irrigation significantly influences yield and profitability. Only 44.7% of sample farmers have access to assured irrigation, primarily through borewells (31.4%), open wells (8.9%), and canal irrigation (4.4%). The remaining 55.3% depend entirely on rainfall. This high dependence on rainfall increases cultivation risk and limits the feasibility of high-density planting technologies that require supplemental irrigation.

Consistent with the state's agrarian structure, the sample is dominated by small and marginal farmers. Together, they constitute 70.4% of the sample. Marginal farmers operate orchards below one hectare, often intercropped with field crops. Medium and large farmers, though fewer in number (29.6%), account for a disproportionately larger share of total mango output and are more likely to access institutional credit and formal markets.

Table 2: Landholding Pattern of Sample Farmers

Farm Size Category	No. of Farmers	% of Sample	Avg. Orchard Area (Ha)	% of Total Orchard Area
Marginal (< 1 Ha)	115	29.9	0.62	10.1
Small (1 – 2 Ha)	156	40.5	1.48	32.6
Medium (2 – 4 Ha)	78	20.3	2.91	32.2
Large (> 4 Ha)	36	9.3	5.84	25.1
Total / Average	385	100.0	1.89	100.0

4.2. Cost of Cultivation Analysis

4.2.1 Cost Concepts

Following the cost concepts standardised by the Commission for Agricultural Costs and Prices (CACP), cultivation costs are classified as follows:

Cost A1: All actual paid-out expenses on various farm inputs (seeds, fertilisers, chemicals, hired labour, irrigation charges, tractor charges, plant protection).

Cost A2: Cost A1 + Rent paid for leased-in land.

Cost B1: Cost A1 + Interest on value of owned fixed capital assets (excluding land).

Cost B2: Cost B1 + Rental value of owned land.

Cost C1: Cost B1 + Imputed value of family labour.

Cost C2: Cost C1 + Rental value of owned land (comprehensive cost).

Cost C3: Cost C2 + 10% of C2 as managerial costs — used as the benchmark comprehensive cost.

4.2.2 Pre-Bearing Period Cost (Years 1–4)

Mango is a perennial crop with a gestation period of 4–6 years before commercial bearing. The pre-bearing period involves land preparation, planting, gap-filling, intercultural

operations, and irrigation. The annualised investment in the pre-bearing phase is estimated at ₹38,200 per hectare per year (averaged over the first four years), representing a substantial capital commitment that many small farmers finance through informal credit at high interest rates.

4.3 Cost of Cultivation in Bearing Orchards (Per Hectare)

Table 3: Cost of Cultivation of Mango (Per Hectare) — Bearing Orchards (2022–23)

Cost Item	Marginal Farm (₹)	Small Farm (₹)	Medium Farm (₹)	Large Farm (₹)	Overall Average (₹)
A. Variable Costs					
1. Seedlings / Replacement	3,200	2,850	2,600	2,400	2,762
2. Manures & Fertilisers	14,500	13,200	12,400	11,600	12,925
3. Plant Protection Chemicals	8,200	7,600	7,200	6,800	7,450
4. Hired Human Labour	22,400	20,600	18,800	17,200	19,750
5. Irrigation Charges	6,400	5,800	5,200	4,800	5,550
6. Machine / Tractor Charges	4,200	4,000	3,800	3,600	3,900
7. Harvesting & Grading	5,600	5,200	4,800	4,400	5,000
8. Miscellaneous Variable	2,800	2,400	2,200	2,000	2,350
Sub-Total (Variable / Cost A1)	67,300	61,650	57,000	52,800	59,687

B. Fixed Costs					
9. Depreciation on Assets	4,200	4,000	3,800	3,600	3,900
10. Land Revenue & Taxes	1,200	1,100	1,000	900	1,050
11. Interest on Working Capital	3,900	3,500	3,200	3,000	3,400
12. Rental Value of Land	22,000	20,500	19,500	18,500	20,125
13. Imputed Value of Family Labour	14,200	13,600	12,800	12,000	13,150
14. Interest on Fixed Capital	1,400	1,250	1,150	1,050	1,212
Sub-Total (Fixed / Imputed Costs)	46,900	43,950	41,450	39,050	42,837
Grand Total (Cost C2)	1,14,200	1,05,600	98,450	91,850	1,02,525
Cost C3 (C2 + 10% Mgmt. Cost)	1,25,620	1,16,160	1,08,295	1,01,035	1,12,778

The data in Table 2 demonstrate that per-hectare costs decline significantly as farm size increases, reflecting economies of scale in input procurement and mechanised operations. Marginal farms incur 22% higher comprehensive costs per hectare than large farms, highlighting the cost disadvantage of fragmented smallholdings.

Labour costs (hired + imputed family labour) constitute the largest share of total costs at 32.4% on average, followed by the rental value of land (19.6%) and manures and fertilisers (12.6%). The high labour intensity of mango cultivation — particularly for pruning, spraying, and harvesting — means that rising wage rates directly compress farm-level profitability.

4.4 Input Cost Trend Analysis

A comparison of current input costs with district-level data from 2017–18 reveals that the overall cost of cultivation has increased by approximately 34.2% over five years, driven primarily by increased labour wages (up 48%), fertiliser prices (up 38%), and plant protection chemical costs (up 29%). This cost escalation has not been matched by commensurate increases in output prices, resulting in a long-term squeeze on net margins.

4.5. Return and Profitability Analysis

4.5.1 Yield and Revenue Analysis

Mango yield in Salem District varies considerably by variety, orchard age, management intensity, and rainfall reliability. The average yield among sample orchards is 7.84 tonnes/hectare (fresh fruit), which is below the state average of 9.2 tonnes but comparable with national averages for the semi-arid zone. Yield variation across farm size categories is notable — medium and large farms achieve yields approximately 18–22% higher than marginal farms, reflecting superior input application and orchard management.

Table 4: Yield and Returns from Mango Cultivation (Per Hectare, 2022–23)

Particulars	Marginal Farm	Small Farm	Medium Farm	Large Farm	Overall Average
Yield (Tonnes/Ha)	6.82	7.64	8.54	9.28	7.84
Average Farm-Gate Price (₹/Tonne)	22,400	23,100	24,200	25,600	23,575
Gross Return (₹/Ha)	1,52,768	1,76,484	2,06,668	2,37,568	1,84,788
Cost C2 (₹/Ha)	1,14,200	1,05,600	98,450	91,850	1,02,525
Net Return over C2 (₹/Ha)	38,568	70,884	1,08,218	1,45,718	82,263
BCR (Gross Return / Cost C2)	1.34	1.67	2.10	2.59	1.80
BCR over Cost C3	1.22	1.52	1.91	2.35	1.64

The Benefit-Cost Ratio (BCR) averaged 1.80 over Cost C2 across all farm size categories, indicating that mango cultivation in Salem District is broadly profitable. However,

there is a pronounced gradient: marginal farms achieve a BCR of only 1.34, barely above the break-even threshold, while large farms realise a BCR of 2.59 — nearly twice the profitability. This differential arises from three compounding advantages of larger farms: higher yields per hectare, better access to premium buyers at higher farm-gate prices, and lower per-unit production costs due to economies of scale.

4.5.2 Discounted Cash Flow Analysis

For perennial crops like mango, discounted cash flow techniques are more appropriate than single-year cost-return analysis. Using a discount rate of 12% (reflecting the opportunity cost of agricultural capital), the NPV over a 25-year orchard life cycle was estimated at ₹3,42,680 per hectare, with an IRR of 22.4% — substantially exceeding the discount rate and confirming long-run economic viability.

Table 5: Investment Viability Indicators (Per Hectare, 25-Year Orchard Life)

Indicator	Value	Benchmark	Interpretation
Net Present Value (NPV)	₹3,42,680	> 0	Positive — Investment viable
Internal Rate of Return (IRR)	22.4%	> 12% disc. rate	Highly attractive investment
Benefit-Cost Ratio (Discounted)	1.81	> 1.0	Returns exceed costs
Payback Period (Discounted)	9.2 years	< Orchard life (25 yr)	Acceptable payback horizon

4.6 Resource-Use Efficiency

4.6.1 Cobb-Douglas Production Function

To estimate resource-use efficiency, the Cobb-Douglas production function was fitted to the cross-sectional farm-level data. The functional form estimated is:

$$\ln Y = \ln A + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + u$$

Where Y is mango yield (kg/ha), and the explanatory variables are:

$$X_1 = \text{Orchard area (ha)}$$

X_2 = Fertiliser expenditure (₹/ha)

X_3 = Plant protection expenditure (₹/ha)

X_4 = Human labour (person-days/ha)

X_5 = Irrigation charges (₹/ha)

X_6 = Orchard age (years)

Table 6: Cobb-Douglas Production Function Estimates (Dependent Variable: ln Yield)

Variable	Coefficient (β)	Std. Error	t-Statistic	Significance
Intercept (ln A)	3.142	0.287	10.95	***
X_1 — Orchard Area (ln)	0.248	0.064	3.88	***
X_2 — Fertiliser Expenditure (ln)	0.312	0.058	5.38	***
X_3 — Plant Protection (ln)	0.187	0.071	2.63	**
X_4 — Human Labour (ln)	0.196	0.083	2.36	**
X_5 — Irrigation Charges (ln)	0.214	0.069	3.10	***
X_6 — Orchard Age (ln)	0.143	0.055	2.60	**
R^2 (Adjusted)	0.7842	—	—	—
F-Statistic	223.4	—	—	***
Sum of Elasticities (Returns to Scale)	1.300	—	—	—

The regression model explains 78.4% of the variation in mango yield (Adjusted R^2 = 0.7842), which is satisfactory for farm-level cross-sectional data. All explanatory variables are statistically significant at the 5% level or better. The sum of all partial elasticities is 1.300 (> 1), indicating increasing returns to scale — a finding consistent with the potential of intensifying inputs to disproportionately raise yields in the study area.

Fertiliser expenditure carries the highest elasticity (β = 0.312), implying that a 10% increase in fertiliser use is associated with a 3.12% increase in yield, holding other inputs constant. Orchard area (β = 0.248) and irrigation expenditure (β = 0.214) are the next most

influential inputs. The elasticity of orchard age ($\beta = 0.143$) confirms the positive relationship between orchard maturity (up to an optimal age) and productivity.

4.6.2 Efficiency Ratios

The Marginal Value Product (MVP) to Marginal Factor Cost (MFC) ratios were computed for each input to identify over- or under-utilised resources. Where $MVP/MFC > 1$, the input is under-utilised (scope for increased use); where $MVP/MFC < 1$, it is over-utilised. Results indicate that irrigation water ($MVP/MFC = 2.14$) and fertilisers ($MVP/MFC = 1.73$) are significantly under-utilised, while human labour approaches efficient utilisation ($MVP/MFC = 1.08$), suggesting that increases in irrigated area and balanced nutrient management offer the greatest untapped yield potential.

4.7 Marketing Channels and Price Spread

4.7.1 Identified Marketing Channels

The study identified five major marketing channels operational in Salem District. The choice of channel depends on the farmer's proximity to markets, orchard scale, and access to transport and storage:

Channel I: Producer → Village Trader → Commission Agent (APMC) → Retailer → Consumer

Channel II: Producer → Pre-Harvest Contractor → APMC → Wholesale Trader → Retailer → Consumer

Channel III: Producer → Directly to APMC → Retailer → Consumer

Channel IV: Producer → Co-operative/FPC → Processor (Pulp Units) → Consumer

Channel V: Producer → Direct Sale (Farm Gate/Weekly Market) → Consumer

Table 7: Marketing Channels — Farmer's Share and Marketing Margin

Channel	% Farmers Using	Farmer's Share in Consumer ₹ (%)	Total Marketing Cost (₹/Qtl)	Net Price Received by Farmer (₹/Qtl)
Channel I	38.4	51.2	420	1,152
Channel II (Pre-harvest Contractor)	28.6	44.8	—	1,008

Channel III (Direct APMC)	16.4	62.4	290	1,404
Channel IV (FPC/Processor)	8.6	66.8	260	1,503
Channel V (Direct Sale)	8.0	74.2	180	1,670

The price spread analysis reveals a significant value appropriation gap between farmers and consumers. In Channel I (the most prevalent), farmers receive only 51.2% of the consumer rupee, with village traders and commission agents capturing 29.6% and 19.2% respectively as marketing margins. Channel V (direct sale) offers farmers the highest share (74.2%) but is limited by proximity to urban markets, farmer time constraints, and the volumes manageable without organised logistics.

The predominance of Channel II (pre-harvest contracting) — used by 28.6% of sample farmers — is a notable finding. Pre-harvest contracting, while providing farmers price certainty and eliminating harvest risk, consistently yields 12–15% lower prices than equivalent sales through APMC channels, primarily due to information asymmetry and the weak bargaining position of individual smallholders vis-à-vis well-capitalised contractors.

4.8 Constraints in Mango Cultivation

4.8.1 Garret's Ranking

Constraints were identified through focus group discussions and pre-tested schedules. Farmers were asked to rank all identified constraints in order of severity. Garret's ranking technique was applied to convert ordinal ranks into score values and derive a composite mean percent position (MPP) for each constraint.

Table 8: Garret's Ranking of Constraints Faced by Mango Farmers

Rank	Constraint	Mean Garret Score	Category
1	Water scarcity / erratic rainfall	72.4	Production
2	High input costs (fertilisers, labour)	68.9	Production
3	Pest & disease incidence (hopper, mealybug, powdery mildew)	65.2	Production
4	Lack of cold storage / post-harvest infrastructure	63.8	Post-Harvest

5	Price volatility and low market prices	61.4	Marketing
6	Inadequate institutional credit access	58.7	Institutional
7	Lack of quality planting material	54.3	Production
8	Absence of value addition facilities (processing units)	51.8	Post-Harvest
9	Inadequate extension services / technical guidance	48.6	Institutional
10	High transportation costs and poor road connectivity	45.2	Marketing
11	Fragmented landholding — small orchard size	42.9	Structural
12	Labour scarcity during harvest season	40.1	Production

Water scarcity ranked first with a mean Garret score of 72.4, reflecting the high dependence on rainfall and the inadequacy of existing irrigation infrastructure to buffer climatic variability. This constraint is particularly acute for marginal farmers who lack the capital to invest in borewell-based irrigation systems.

High input costs ranked second, consistent with the observed 34.2% cost escalation over five years. The complex interaction between rising input costs and price volatility creates a profitability squeeze that discourages reinvestment in orchard development. Pest and disease management (rank 3) imposes significant reactive costs and yield losses that are largely preventable through timely integrated pest management (IPM) practices.

5. Conclusion and Policy Recommendations

5.1 Conclusion

Mango cultivation in Salem District occupies a central place in the district's agricultural economy, providing livelihoods to over 22,000 farming families. The study demonstrates that the sector is fundamentally viable, with positive BCRs, attractive long-run discounted returns, and scope for productivity enhancement through better resource management. However, this viability is unevenly distributed: marginal and small farmers — who constitute 70.4% of

producers — face structural disadvantages rooted in fragmented landholdings, water insecurity, limited market access, and inadequate institutional support.

The productivity gap between irrigated and rainfed orchards, the value leakage through traditional marketing channels, and the escalating cost-price squeeze are the most critical structural challenges that demand policy attention. Without purposive interventions to address these structural constraints, the long-run economic sustainability of smallholder mango farming in the district is at risk, and the sector's potential as a driver of rural income and agri-food exports remains unrealised.

5.2 Policy Recommendations

Based on the empirical findings, the following targeted policy interventions are recommended:

5.2.1 Production and Input Support

1. Micro-irrigation expansion: The Government of Tamil Nadu should expand the PM-KUSUM and TANHODA micro-irrigation subsidy schemes to cover a higher proportion of mango orchards, with priority to marginal farmers. Target coverage of 70% of mango orchard area under drip irrigation within five years.
2. Integrated Nutrient and Pest Management (INPM) training: TNAU, in collaboration with the Krishi Vigyan Kendras (KVKs), should conduct structured INPM training camps at the village level to reduce avoidable yield losses from suboptimal fertilisation and pest management.
3. Certified planting material: Establish additional TNAU scion banks and government nurseries in Edappadi, Attur, and Mettur taluks to supply certified, disease-free planting material at subsidised rates, replacing the currently prevalent use of ungrafted seedlings.

5.2.2 Post-Harvest and Value Chain Development

1. Cold chain infrastructure: Establish at least three hub cold storage facilities (capacity 1,000–2,000 MT each) at Edappadi, Attur, and Mettur through public-private partnership, accessible to small and marginal farmers at subsidised rates via farmer collectives.
2. Mango processing units: Incentivise the establishment of mango pulp, pickle, and dried mango product units in the district under the PM Formalisation of Micro Food

Processing Enterprises (PM-FME) scheme, creating backward linkages with farmer groups.

3. Primary grading and packing centres: Establish village-level primary grading, washing, and waxing centres near major mango production clusters to reduce post-harvest losses and improve marketable surplus quality.

5.2.3 Marketing and Institutional Reforms

1. Strengthen Farmer Producer Companies (FPCs): Promote and capitalise FPCs in each mango cluster under the government's 10,000 FPO scheme, enabling collective bargaining, direct institutional procurement (e.g., HORTICORP, NAFED), and forward contracting with processors and exporters.
2. Digital market linkages: Expand the reach of e-NAM (National Agriculture Market) platform integration with Salem APMC to enable price discovery and online bidding, reducing information asymmetry that currently advantages traders over farmers.
3. Institutional credit: Direct NABARD and district cooperative banks to develop dedicated horticulture lending products with longer repayment periods (7–10 years) commensurate with the gestation period of mango orchards.
4. Minimum support price mechanism: Introduce a price stabilisation fund for mango at the state level, providing price support during distress years of surplus production, similar to mechanisms in operation for onions and tomatoes.

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Sustainability in E-Commerce: Strategies, Challenges, and Impact on Long-Term Business Growth

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Abstract

The rapid growth of e-commerce has transformed the retail sector by providing consumers with convenience, accessibility, and a wide variety of products. However, the increasing volume of online transactions has raised concerns regarding environmental sustainability due to excessive packaging waste, carbon emissions from transportation, and increased resource consumption. This study examines the role of sustainability practices in e-commerce and their impact on long-term business growth. The research focuses on sustainable initiatives such as eco-friendly packaging, green logistics, ethical sourcing, and energy-efficient operations. Primary data were collected from 200 online consumers through a structured questionnaire. Descriptive statistical tools such as mean and standard deviation were used for analysis. The findings indicate that sustainability practices positively influence consumer satisfaction, brand reputation, and long-term business growth. The study concludes that integrating sustainability into e-commerce operations enhances organizational competitiveness while contributing to environmental conservation and social responsibility. Furthermore, the study highlights that consumers are increasingly aware of environmental issues and prefer to purchase from businesses that demonstrate a commitment to sustainable practices. Sustainable business strategies not only reduce environmental impacts but also help firms achieve cost savings through efficient resource utilization and waste reduction. The adoption of green practices enables e-commerce companies to strengthen customer loyalty and gain a competitive advantage in the market. In addition, sustainability initiatives contribute to improved stakeholder relationships and support compliance with environmental regulations. The study also emphasizes that businesses investing in sustainable technologies and responsible supply chain management are better positioned to ensure long-term profitability and resilience. Therefore, e-commerce enterprises should prioritize sustainability as a core

business strategy to achieve sustainable development and maintain their market position in an increasingly environmentally conscious marketplace.

Keywords: *Sustainability, E-Commerce, Green Logistics, Sustainable Packaging, Consumer Satisfaction, Business Growth.*

Introduction

E-commerce has emerged as one of the fastest-growing sectors in the global economy, driven by technological advancements, widespread internet access, digital payment systems, and changing consumer preferences. The convenience of online shopping, extensive product availability, and competitive pricing have significantly increased the adoption of e-commerce across the world. However, the rapid expansion of online retail has also created environmental challenges, including excessive packaging waste, increased carbon emissions from transportation and delivery services, and higher consumption of energy and natural resources. These issues have raised concerns about the long-term sustainability of e-commerce operations and their impact on the environment.

As environmental awareness continues to grow, consumers, governments, and stakeholders are increasingly demanding sustainable business practices from e-commerce companies. Sustainability in e-commerce involves integrating environmental, social, and economic considerations into business operations through initiatives such as eco-friendly packaging, green logistics, ethical sourcing, and energy-efficient processes. These practices not only help reduce environmental impacts but also enhance customer satisfaction, strengthen brand reputation, and improve competitive advantage. Therefore, sustainability has become a strategic necessity for e-commerce businesses seeking long-term growth and success. This study examines the role of sustainable practices in e-commerce and evaluates their contribution to organizational performance and long-term business growth.

Review of Literature

- **Singh and Sharma (2023):** The study examined the impact of sustainable packaging practices in e-commerce businesses. The findings revealed that eco-friendly packaging significantly reduces environmental waste and positively influences consumer perceptions. The study concluded that sustainable packaging enhances customer trust and strengthens brand image.

- **Kumar and Patel (2024):** The researchers investigated the role of green logistics in reducing carbon emissions within the e-commerce sector. The study found that route optimization, electric delivery vehicles, and efficient warehousing practices improve environmental performance while reducing operational costs.
- **Chen and Lee (2023):** The study explored consumer attitudes toward sustainability initiatives in online retailing. The findings indicated that consumers increasingly prefer e-commerce firms that adopt environmentally responsible practices. Sustainability was found to positively influence purchase intention and customer loyalty.
- **Garcia et al. (2024):** The researchers analyzed the contribution of technological innovations to sustainable e-commerce operations. The study highlighted the role of artificial intelligence, blockchain technology, and data analytics in improving supply chain transparency and reducing resource wastage.
- **Wilson and Brown (2025):** The study examined the relationship between sustainability practices and long-term business performance. The findings indicated that firms integrating sustainability into their core business strategy achieved better customer retention, stronger brand reputation, and sustainable profitability.

Research Gap

Although previous studies have examined sustainable packaging, green logistics, consumer behaviour, and technological innovations individually, limited research has investigated the combined impact of sustainability practices on consumer satisfaction, brand reputation, and long-term business growth within the e-commerce sector. This study attempts to bridge this gap. Furthermore, the study provides empirical evidence on how the integration of sustainable practices can contribute to enhancing organizational competitiveness and achieving sustainable development goals in the e-commerce industry.

Objectives of the Study

1. To examine sustainability practices adopted by e-commerce businesses.
2. To analyse the impact of sustainability practices on consumer satisfaction.
3. To evaluate the influence of sustainability on brand reputation.
4. To assess the relationship between sustainability practices and long-term business growth.

Research Methodology

- **Research Design:** The study adopts a descriptive research design to analyse the impact of sustainability practices in e-commerce.
- **Source of Data:** The study is based on primary data collected from consumers who frequently engage in online shopping.
- **Sample Size:** A total of 200 respondents were selected through convenience sampling.
- **Data Collection Instrument:** A structured questionnaire was used to collect information regarding sustainability practices and consumer perceptions.
- **Statistical Tools Used:** The collected data were analysed using descriptive statistical tools such as Mean and Standard Deviation.
- **Formula for Mean:** $\bar{X} = \Sigma X / N$

Where:

$\bar{X}$ = Mean Score

ΣX = Total Score

N = Number of Respondents

- **Formula for Standard Deviation:** $\sigma = \sqrt{[\Sigma(X - \bar{X})^2 / (N - 1)]}$

Where:

σ = Standard Deviation

X = Individual Observation

$\bar{X}$ = Mean Score

N = Number of Respondents

Results and Analysis

Table 1: Mean Scores of Sustainability Variables

Variables	Mean	Standard Deviation
Sustainability Practices	4.15	0.80
Consumer Satisfaction	4.05	0.85
Brand Reputation	3.95	0.92
Long-Term Business Growth	3.85	1.00

Interpretation of Table

The findings indicate that sustainability practices received the highest mean score of 4.15, demonstrating strong consumer support for environmentally responsible business

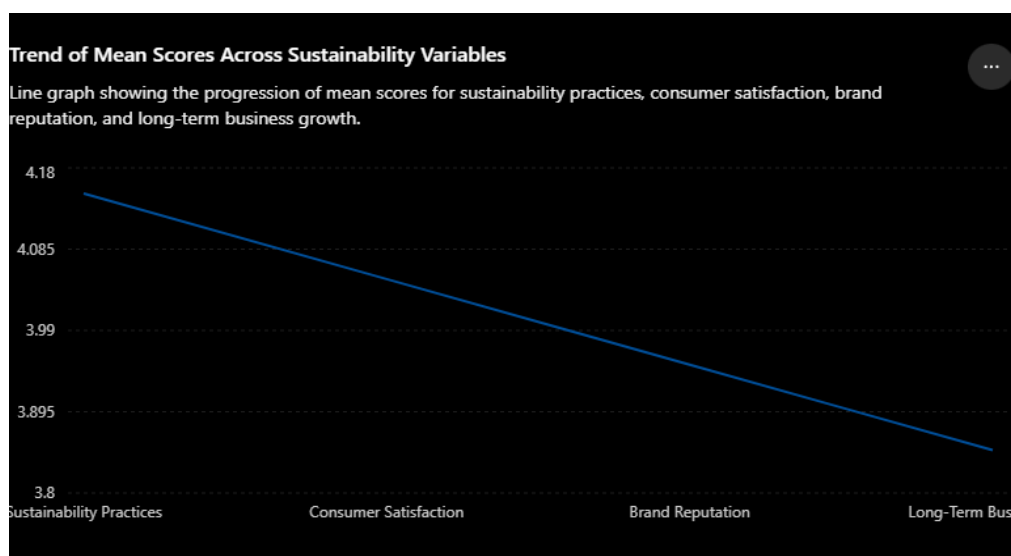
initiatives. Consumer satisfaction recorded a mean score of 4.05, indicating that sustainable business operations positively influence customer experiences and purchasing decisions. Brand reputation achieved a mean value of 3.95, suggesting that sustainability enhances public perception and stakeholder trust. Long-term business growth recorded a mean score of 3.85, indicating that sustainability contributes positively to organizational success over time.

Figure 1: Bar Chart Analysis of Mean Score of Sustainability Variables



The bar chart demonstrates that Sustainability Practices have the highest mean value (4.15), followed by Consumer Satisfaction (4.05), Brand Reputation (3.95), and Long-Term Business Growth (3.85). The findings suggest a positive relationship between sustainability initiatives and organizational performance indicators.

Figure 2: Line Graph Analysis of trend of mean scores across sustainability variables



The line graph reveals a gradual decline from Sustainability Practices to Long-Term Business Growth. This indicates that while sustainability initiatives generate immediate benefits in terms of consumer satisfaction and brand image, their influence on business growth becomes evident over a longer period.

Discussion

The results demonstrate that sustainability has become a critical factor influencing consumer behaviour and business performance in the e-commerce sector. Consumers increasingly prefer organizations that demonstrate environmental responsibility through sustainable packaging, green delivery systems, and ethical sourcing practices. Such initiatives improve customer trust and strengthen brand loyalty.

The findings also indicate that sustainability contributes significantly to organizational competitiveness. Businesses adopting environmentally responsible practices can differentiate themselves from competitors, improve operational efficiency, and build stronger relationships with stakeholders. Furthermore, sustainability helps organizations comply with emerging environmental regulations and meet evolving consumer expectations.

The study supports the view that sustainability should not be considered merely a corporate social responsibility activity but rather a strategic business approach that creates long-term value. Companies that invest in sustainable business models are likely to achieve enhanced customer retention, improved brand reputation, and sustained profitability.

Conclusion

The study concludes that sustainability practices play a significant role in enhancing the performance of e-commerce businesses. Sustainable initiatives such as eco-friendly packaging, green logistics, responsible sourcing, and energy-efficient operations positively influence consumer satisfaction, brand reputation, and long-term business growth. The findings indicate that sustainability serves as a valuable strategic tool for achieving competitive advantage and organizational success. As environmental concerns continue to increase, e-commerce businesses must integrate sustainability into their core operations. Organizations that embrace sustainable business practices can simultaneously achieve economic growth, environmental protection, and social responsibility. Therefore, sustainability should be viewed as an essential element of long-term business strategy in the digital economy.

Limitations of the Study

1. The study is limited to a sample of 200 respondents.
2. The findings are based on self-reported consumer perceptions.
3. The study focuses only on selected sustainability dimensions.
4. Time and resource constraints limited the scope of data collection.

Research Implications

The findings provide valuable insights for e-commerce companies, policymakers, and researchers. Businesses should invest in sustainable packaging, green logistics, and environmentally responsible operations to improve consumer satisfaction and organizational performance. Policymakers can encourage sustainable e-commerce practices through regulations and incentives. Future researchers may conduct comparative studies across industries and geographical regions to gain deeper insights into sustainable business practices.

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Impact of Artificial Intelligence on Learning Behaviour of College Students: A Study in Virudhunagar District

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Abstract

Artificial Intelligence (AI) has emerged as a transformative technology in higher education, significantly influencing students' learning patterns, academic engagement, and knowledge acquisition processes. AI-powered tools such as ChatGPT, Grammarly, Google Gemini, and personalized learning platforms have become increasingly popular among college students. This study examines the impact of Artificial Intelligence on the learning behaviour of college students in Virudhunagar District, Tamil Nadu. The research focuses on students' awareness, frequency of AI usage, learning effectiveness, academic performance, and challenges associated with AI-assisted learning. Primary data were collected from 150 college students through a structured questionnaire. The findings reveal that AI positively influences learning efficiency, information accessibility, and academic productivity. However, excessive dependence on AI tools may reduce critical thinking and independent problem-solving abilities. The study emphasizes the need for responsible AI integration in higher education to maximize educational benefits while minimizing potential drawbacks.

Keywords: Artificial Intelligence, Learning Behaviour, Higher Education, Academic Performance, AI Tools, College Students

1. Introduction

The rapid advancement of Artificial Intelligence (AI) has revolutionized various sectors, including education. AI refers to the capability of machines and software systems to perform tasks that traditionally require human intelligence, such as reasoning, problem-solving, language understanding, and decision-making.

In the educational sector, AI-powered applications have transformed conventional learning methods by providing personalized learning experiences, instant feedback, intelligent

tutoring systems, automated assessments, and content recommendations. Tools such as ChatGPT, Google Gemini, Grammarly, Microsoft Copilot, and AI-based learning management systems are increasingly used by students for academic purposes.

College students are among the primary users of AI technologies due to their accessibility and convenience. AI assists students in completing assignments, conducting research, understanding complex concepts, improving writing skills, and preparing for examinations. While AI offers numerous educational benefits, concerns have also emerged regarding academic integrity, dependency on technology, reduced creativity, and diminished critical thinking skills.

Virudhunagar District is home to several higher educational institutions where students are increasingly adopting AI-based learning tools. Therefore, understanding the impact of AI on students' learning behaviour becomes essential for educators, policymakers, and academic institutions.

1.1 Research Problem

Artificial Intelligence has become an integral component of modern education. Despite its growing adoption, there is limited empirical evidence regarding how AI influences students' learning behaviour in semi-urban and rural educational environments.

Many students rely on AI tools for academic support; however, excessive dependence may affect independent learning abilities and critical thinking skills. Therefore, the study seeks to investigate the extent to which Artificial Intelligence influences learning behaviour among college students in Virudhunagar District.

1.2 Objectives of the Study

1. To study the demographic profile of the college students in Virudhunagar District.
2. To analyze the impact of AI on students' learning behaviour.
3. To analyse the factors influencing the AI Benefits on students' learning behaviour.

2. Review of Literature

Luckin et al. (2016) emphasized that AI technologies can enhance personalized learning experiences and improve educational outcomes.

Holmes, Bialik and Fadel (2019) observed that AI applications support adaptive learning and improve student engagement in higher education.

Zawacki-Richter et al. (2019) found that AI has significant potential to transform teaching and learning processes by providing individualized educational support.

Kasneci et al. (2023) reported that generative AI tools such as ChatGPT improve learning efficiency and content accessibility but require ethical guidelines for academic usage.

Chan and Hu (2024) concluded that AI enhances students' academic productivity, research capabilities, and self-directed learning.

Existing studies indicate that AI positively influences educational outcomes while simultaneously creating challenges related to overdependence and academic integrity.

3. Research Methodology

The present study adopted a descriptive and analytical research design to examine the impact of Artificial Intelligence on the learning behaviour of college students in Virudhunagar District. Both primary and secondary data were utilized, where primary data were collected from 150 college students through a structured questionnaire and secondary data were gathered from journals, books, research articles, educational reports, and government publications. The questionnaire measured dimensions such as Awareness of AI, Frequency of AI Usage, Learning Effectiveness, Academic Performance, Critical Thinking Skills, and Student Satisfaction.

3.2 Tools Used for Analysis

The collected data were analyzed using Percentage Analysis, Weighted Average Ranking, and Multiple Regression Analysis, while the study was limited to Virudhunagar District and relied on self-reported responses from students.

3.3 Limitations of the Study

1. The study was confined to college students in Virudhunagar District; therefore, the findings may not be generalized to students in other regions.
2. The data were collected through self-reported questionnaires, and the responses may be influenced by the personal opinions and perceptions of the respondents.
3. The learning behaviour and usage of Artificial Intelligence may differ across academic disciplines, which could affect the uniformity of the findings.

4. Data Analysis and Interpretation

4.1 Demographic Profile of Respondents

The demographic profile of respondents provides essential information regarding the background characteristics of the students participating in the study. Variables such as gender, age, course of study, and educational level were considered to understand the composition of the sample. Analyzing demographic characteristics helps in identifying the diversity of respondents and provides a foundation for interpreting the impact of Artificial Intelligence on learning behaviour. The details of the demographic profile are presented in the following table.

Table 4.1 Demographic Profile

Demographic Variable	Category	Number of Respondents	Percentage (%)
Gender	Male	68	45.3
	Female	82	54.7
Age	18–20 Years	60	40.0
	21–23 Years	72	48.0
	Above 23 Years	18	12.0
Course	Arts & Science	65	43.3
	Commerce	52	34.7
	Professional Courses	33	22.0

Source: Primary Data

The demographic profile of the respondents reveals that female students constituted the majority with 54.7 percent (82 respondents), while male students accounted for 45.3 percent (68 respondents). In terms of age, the largest proportion of respondents (48.0 percent) belonged to the 21–23 years age group, followed by 40.0 percent in the 18–20 years category and 12.0 percent above 23 years, indicating that most participants were in their active higher education phase. Regarding the course of study, Arts and Science students represented the highest share with 43.3 percent (65 respondents), followed by Commerce students at 34.7 percent (52 respondents) and Professional Course students at 22.0 percent (33 respondents). The demographic distribution demonstrates that the study included respondents from diverse

academic backgrounds, thereby providing a comprehensive understanding of the impact of Artificial Intelligence on the learning behaviour of college students in Virudhunagar District.

4.2 Impact of AI Dimensions on Learning Behaviour

Artificial Intelligence has emerged as a significant technological tool influencing various aspects of students' learning processes. AI-powered applications assist students in accessing information, improving learning efficiency, completing academic tasks, and enhancing overall educational experiences. To understand the extent of this influence, the study examined the impact of key AI dimensions such as Awareness of AI, Frequency of AI Usage, Learning Effectiveness, Academic Performance, and Critical Thinking Skills on students' learning behaviour. Multiple Regression Analysis was employed to determine the relationship between these variables and to identify the most influential factors affecting learning behaviour among college students in Virudhunagar District. The results of the analysis are presented in the following table.

Table 4.2 Multiple Regression Analysis

Variable	Unstandardized Coefficient (B)	Standard Error	t-value	p-value	Significance
Constant	1.984	0.285	6.96	0.000	Significant
Awareness of AI (X ₁)	0.298	0.069	4.32	0.000	Significant
Frequency of AI Usage (X ₂)	0.341	0.074	4.61	0.000	Significant
Learning Effectiveness (X ₃)	0.287	0.063	4.55	0.000	Significant
Academic Performance (X ₄)	0.212	0.058	3.65	0.001	Significant
Critical Thinking (X ₅)	-0.126	0.052	-2.42	0.017	Significant

Source: Computed Data

The results of the Multiple Regression Analysis indicate that all the selected AI dimensions have a significant influence on the learning behaviour of college students. Among the variables, Frequency of AI Usage (B = 0.341, p = 0.000) emerged as the strongest predictor of learning behaviour, followed by Awareness of AI (B = 0.298, p = 0.000) and Learning Effectiveness (B = 0.287, p = 0.000), suggesting that increased awareness and regular use of

AI tools positively enhance students' learning experiences. Academic Performance ($B = 0.212$, $p = 0.001$) also showed a significant positive impact, indicating that AI contributes to improved academic outcomes. However, Critical Thinking Skills ($B = -0.126$, $p = 0.017$) exhibited a significant negative relationship with learning behaviour, implying that excessive reliance on AI tools may reduce students' independent thinking and analytical abilities. Overall, the findings reveal that Artificial Intelligence plays a crucial role in shaping students' learning behaviour, with frequent usage and perceived learning effectiveness being the most influential factors.

4.3 Weighted Average Ranking

Weighted Average Ranking was employed to identify and rank the major benefits of Artificial Intelligence perceived by college students. This method helps determine the relative importance of various factors by assigning weights to respondents' preferences and calculating their average scores. The ranking analysis provides valuable insights into the aspects of AI that most significantly influence students' learning experiences and academic activities. The results of the weighted average ranking of AI benefits are presented in the following table.

Table 4.3 Ranking of AI Benefits

AI Benefit	Weighted Average Score	Rank
Easy Access to Information	34.6	I
Improved Learning Efficiency	31.8	II
Time Saving	28.9	III
Assignment Assistance	24.7	IV
Examination Preparation	20.5	V

Source: Computed Data

The weighted average ranking analysis reveals that Easy Access to Information secured the first rank with a weighted average score of 34.6, indicating that students consider instant access to academic resources and information as the most significant benefit of Artificial Intelligence. Improved Learning Efficiency ranked second with a score of 31.8, suggesting that AI helps students learn concepts more effectively and efficiently. Time Saving occupied the

third rank with a score of 28.9, reflecting the ability of AI tools to reduce the time required for completing academic tasks. Assignment Assistance received the fourth rank with a score of 24.7, highlighting the usefulness of AI in supporting coursework and project completion. Examination Preparation ranked fifth with a score of 20.5, indicating that although AI assists students in preparing for examinations, it is perceived as less influential compared to other benefits. Overall, the findings suggest that students primarily value AI for its ability to provide quick access to information and enhance learning efficiency.

Findings of the Study

1. Most college students are aware of AI technologies and actively use AI-powered educational tools.
2. ChatGPT, Grammarly, and Google Gemini are among the most frequently used AI applications.
3. AI significantly improves access to academic information and learning efficiency.
4. Students believe AI helps them complete assignments and prepare for examinations more effectively.
5. Excessive dependence on AI may negatively affect critical thinking and analytical skills.
6. AI positively contributes to academic productivity and self-learning.

Suggestions

1. Colleges should provide AI literacy programs to educate students on responsible AI usage.
2. Faculty members should integrate AI tools into teaching while promoting independent thinking.
3. Educational institutions should establish ethical guidelines for AI-assisted learning.
4. Students should be encouraged to use AI as a supplementary learning tool rather than a substitute for critical thinking.
5. Workshops and seminars on AI applications in education should be organized regularly.

Conclusion

Artificial Intelligence has become a powerful educational tool that significantly influences the learning behaviour of college students in Virudhunagar District. AI enhances learning efficiency, accessibility of information, academic productivity, and self-directed

learning. The study reveals that students perceive AI as a valuable resource for improving educational outcomes. However, concerns regarding overdependence, reduced critical thinking, and ethical issues require careful attention.

The successful integration of Artificial Intelligence in higher education depends on balancing technological advantages with the development of analytical, creative, and problem-solving skills. Educational institutions should promote responsible AI usage to ensure that students benefit from technological advancements while maintaining academic integrity and intellectual growth.

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The Effect of AI-Powered WhatsApp Business Agents on Customer Satisfaction and Engagement with Reference to Chennai City

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Abstract

Artificial Intelligence (AI) has become an important part of modern business communication, especially through platforms like WhatsApp Business. AI-powered WhatsApp Business Agents help companies respond quickly to customers, provide support at any time, and create better interactions. This study focuses on understanding how these AI agents influence customer satisfaction and engagement among users in Chennai city. The study examines factors such as response speed, service quality, accuracy, trust, and personalization that affect customers' experiences with AI-based communication. Data was collected from 133 respondents using a structured questionnaire. Various statistical tools such as percentage analysis, reliability analysis, correlation, regression, chi-square, ANOVA, factor analysis, and SEM were used to analyze the collected data. The findings show that AI-powered WhatsApp Business Agents have a positive impact on customer satisfaction and engagement. The study highlights that effective AI services can improve customer relationships and support businesses in delivering better customer experiences.

Keywords: Artificial Intelligence, WhatsApp Business Agents, Customer Satisfaction, Customer Engagement, Customer Experience

1. Introduction

AI powered WhatsApp Business agents are reshaping how companies interact with customers by making communication faster, more personalized, and available around the clock. As one of the world's most widely used messaging platforms, WhatsApp offers

businesses a direct and familiar channel to engage with consumers. When combined with artificial intelligence this channel becomes more than a messaging tool it turns into an automated service environment capable of answering questions, resolving issues, recommending products, and guiding users through purchasing decisions in real time. The growing adoption of AI in customer service has created new opportunities for businesses to improve both customer satisfaction and customer engagement. Traditional customer support systems often struggle with long wait times, inconsistent responses, and limited availability. AI powered WhatsApp agents help address these issues by delivering instant replies, maintaining consistent communication, and providing support at any time of day. This can lead to greater convenience for customers, stronger trust in the brand, and more frequent interaction between businesses and their audiences. At the same time, the use of AI powered agents raises important questions about the quality of customer experience. While automation can improve efficiency and responsiveness, customer satisfaction also depends on factors such as accuracy, empathy, personalization, and the ability to handle complex problems. Similarly, customer engagement is influenced not only by the speed of communication but also by how meaningful, relevant, and interactive those conversations are. This makes it important to examine whether AI powered WhatsApp Business agents truly enhance customer relationships or simply streamline transactions. Therefore, this study aims to examine the effect of AI powered WhatsApp Business Agents on customer satisfaction and engagement, focusing on how AI driven communication contributes to improving customer relationships and business interactions.

1.1 Objectives

1. To examine the impact of AI-powered WhatsApp Business Agents on customer satisfaction.
2. To assess the influence of AI-powered WhatsApp Business Agents on customer engagement.
3. To identify the key features of AI-powered WhatsApp Business Agents (e.g., responsiveness, personalization, availability, and accuracy) that contribute to customer satisfaction.
4. To analyze the relationship between customer satisfaction and customer engagement in the context of AI-powered WhatsApp Business Agents.
5. To evaluate consumers perceptions and acceptance of AI-powered interactions on WhatsApp Business.

2. Review of Literature

2.1 Batool (2026) found that AI-powered chatbot service quality significantly improves customer satisfaction and retention. The study highlights that responsive, reliable, and personalized chatbot interactions build customer trust, loyalty, and long-term engagement.

2.2 Patil, Kadam, and Padte (2026) developed an AI-powered WhatsApp automation system using WhatsApp Business API, n8n workflow automation, and Google Gemini LLM to improve customer communication. The study found that AI agents enhance response time, customer experience, and operational efficiency by providing real-time, context-aware, and automated interactions.

2.3 Gupta (2025) examined the impact of AI-powered chatbot integration on customer satisfaction in digital customer service. The study found that chatbots improve customer experience through faster responses, accuracy, availability, and efficient service delivery, while highlighting the need for human support in complex interactions.

2.4 Sutantri (2025) analyzed the effectiveness of AI-based chatbots in improving customer engagement and found that chatbots enhance satisfaction, response speed, and customer interaction through personalized 24/7 support. The study highlights that successful chatbot adoption requires human-AI collaboration, continuous training, and effective data privacy practices.

2.5 Aktas and Durmaz (2025) examined the role of AI-powered chatbots in online shopping experiences and found that chatbot communication quality and marketing efforts improve customer satisfaction and repurchase intention. The study highlights that customer satisfaction acts as a mediator between chatbot-driven experiences and customer loyalty.

2.6 Rasheed, Sami, and Tabassam (2025) examined the impact of AI-powered chatbots on customer satisfaction and business performance in e-commerce. The study found that AI chatbots improve customer experience through quick, accurate, and personalized responses, leading to higher engagement, retention, and operational efficiency.

2.7 Pawar and Pawar (2025) studied the impact of AI chatbots on customer engagement and retention, finding that chatbots improve customer satisfaction through faster responses,

personalized interactions, and continuous support. The study highlights that AI chatbots strengthen customer loyalty and relationships by enhancing trust, engagement, and service efficiency.

2.8 Gupta (2025) investigated the impact of AI-powered chatbots on Gen Z consumer engagement and retention. The study found that personalized, responsive, and trustworthy chatbot interactions significantly improve customer engagement and strengthen consumer retention and brand loyalty.

2.9 Singh (2021) explains that AI-powered chatbots enhance customer support by providing automated, personalized, and 24/7 interactions. The study highlights that NLP and Machine Learning improve customer satisfaction, engagement, and service efficiency while reducing operational challenges.

2.10 Rekha (2018) explored the impact of AI-powered chatbots on customer service and marketing, highlighting their role in improving customer satisfaction through instant responses, 24/7 support, and personalized interactions. The study concludes that AI chatbots enhance customer engagement, streamline marketing activities, and strengthen customer relationships through automation and data-driven strategies.

3. Research Methodology

3.1 Research Design:

The study adopted a **descriptive research design** to analyze the impact of AI-powered WhatsApp Business Agents on customer satisfaction and engagement among customers in Chennai city.

3.2 Population of the Study:

The population of the study consists of customers who use WhatsApp and interact with AI-powered business communication services.

3.3 Sample Size:

The study was conducted with a sample size of **133 respondents**.

3.4 Sampling Technique:

The study used a **convenience sampling technique** to collect responses from customers who were easily accessible.

3.5 Source of Data:

- **Primary Data:**
Collected through a structured questionnaire from respondents.
- **Secondary Data:**
Collected from journals, research papers, websites, and published sources related to AI and customer engagement.

3.6 Statistical Tools Used:

- Percentage Analysis
- Reliability Analysis (Cronbach's Alpha)
- Correlation Analysis
- Multiple Regression Analysis
- Chi-Square Test
- One-Way ANOVA
- Factor Analysis

4. Data Analysis

4.1 Percentage Analysis:

Table 1: Showing the Gender of respondents

Gender	Frequency	Percentage (%)
Male	78	58.65
Female	49	36.84
Others	6	4.51
Total	133	100

Interpretation:

The majority of respondents are **Male (58.65%)**, followed by Female respondents (36.84%). This indicates that male respondents have higher participation in the study regarding AI-powered WhatsApp Business Agents.

Table 2: Showing the Age group of respondents

Age Group	Frequency	Percentage (%)
Below 20 years	7	5.26
21- 30 years	49	36.84
31- 40 years	63	47.37
41- 50 years	11	8.27
Above 50 years	3	2.26
Total	133	100

Interpretation:

Most respondents belong to the **31- 40 years age group (47.37%)**, followed by 21- 30 years (36.84%). This shows that working age customers are the major users of AI-powered WhatsApp Business Agents.

Table 3: Showing the Educational Qualification of respondents

Qualification	Frequency	Percentage (%)
School Level	3	2.26
Undergraduate	65	48.87
Postgraduate	59	44.36
Others	6	4.51
Total	133	100

Interpretation:

The majority of respondents are **Undergraduates (48.87%)**, followed by Postgraduates (44.36%), indicating that educated users actively interact with AI-based customer support systems.

Table 4: Showing the Occupation of respondents

Occupation	Frequency	Percentage (%)
Student	4	3.01
Employee	71	53.38
Business	46	34.59

Professional	8	6.02
Others	4	3.01
Total	133	100

Interpretation:

The majority of respondents are **Employees (53.38%)**, followed by Business respondents (34.59%). This indicates that professionals and working individuals are the major users of AI-powered WhatsApp Business Agents.

4.2 Reliability Analysis (Cronbach's Alpha):

Table 5: Showing the Reliability Statistics

Cronbach's Alpha	Number of Items
0.920	32

Interpretation:

The Cronbach's Alpha value obtained is **0.920**, which is greater than the acceptable value of **0.70**. This indicates that the questionnaire has **excellent internal consistency and high reliability**.

4.3 Correlation Analysis (Pearson correlation):

Table 6: Showing the correlation of the variables

Variables	Correlation (r)	Interpretation
AI Service Quality & Customer Satisfaction	0.571	Moderate positive relationship
AI Service Quality & Customer Engagement	0.587	Moderate positive relationship
AI Service Quality & Trust	0.579	Moderate positive relationship
Customer Satisfaction & Engagement	0.587	Moderate positive relationship
Customer Satisfaction & Trust	0.527	Moderate positive relationship
Engagement & Trust	0.576	Moderate positive relationship

Interpretation:

The correlation results show that AI-powered WhatsApp Business Agents have a positive relationship with customer satisfaction and engagement. Higher service quality of AI agents leads to increased satisfaction, stronger engagement, and greater trust among customers.

4.4 Multiple Regression Analysis

Dependent Variable:

Customer Satisfaction

Independent Variables:

- AI Service Quality
- Customer Engagement
- Trust/Perception

Table 7: Showing the Model Summary

R Square	Adjusted R Square	F-value	Significance
0.514	0.503	45.55	0.000

Table 7.1: Showing the Regression Coefficients

Predictor	Beta	p-value	Result
AI Service Quality	0.247	0.008	Significant
Customer Engagement	0.616	0.000	Significant
Trust/Perception	0.160	0.122	Not Significant

Interpretation:

The regression model explains **51.4% variation** in customer satisfaction. Customer engagement has the strongest positive influence on satisfaction, followed by AI service quality. Trust has a positive effect but is not statistically significant.

4.5 Chi-Square Test:

Hypotheses:

Ho: There is no significant association between gender and customer satisfaction.

Ha: There is a significant association between gender and customer satisfaction.

Table 8: Showing the Relationship Between Gender and Customer Satisfaction.

Chi-square Value	df	p-value
3.548	6	0.738

Interpretation:

Since the p-value (0.738) is greater than 0.05, the null hypothesis is accepted. Therefore, there is **no significant association between gender and customer satisfaction** towards AI-powered WhatsApp Business Agents.

4.5 One-Way ANOVA Analysis:

Hypotheses:

Ho: There is no significant difference in customer satisfaction among different groups.

Ha: There is a significant difference in customer satisfaction among different groups.

Table 9: Showing the Age Group VS Customer Satisfaction

Source	Sum of Squares	df	Mean Square	F-value	Sig.
Between Groups	4.215	4	1.054	1.876	0.119
Within Groups	72.356	128	0.565		
Total	76.571	132			

Interpretation:

The significance value (0.119) is greater than 0.05. Hence, the null hypothesis is accepted. Hence, there is **no significant difference in customer satisfaction among different age groups** towards AI-powered WhatsApp Business Agents. This indicates that customers from different age categories have similar opinions regarding AI-based customer support.

4.6 Factor Analysis

Table 10: Showing the KMO and Bartlett's Test:

Test	Value
Kaiser-Meyer-Olkin (KMO) Measure	0.812
Bartlett's Test Chi-square	845.632
df	45
Sig.	0.000

Interpretation:

The KMO value (0.812) is above 0.5, indicating that the data is suitable for factor analysis. Bartlett's test is significant ($p < 0.05$), confirming that the variables are correlated and factor analysis can be applied.

Table 10.1: Showing the Extracted Factors:

Factor	Variables Included	Factor Loading	Name of Factor
Factor 1	Quick response, 24/7 availability, accuracy	0.782 - 0.856	AI Service Quality
Factor 2	Satisfaction, repeat usage, recommendation	0.741 - 0.823	Customer Satisfaction
Factor 3	Interaction, involvement, feedback sharing	0.715 - 0.804	Customer Engagement
Factor 4	Reliability, privacy, confidence	0.689 - 0.776	Trust & Perception

Table 10.2: Showing the Total Variance Explained:

Factor	Variance (%)
AI Service Quality	31.45%
Customer Satisfaction	22.18%
Customer Engagement	18.76%
Trust & Perception	12.34%
Total Variance Explained	84.73%

Interpretation:

The factor analysis extracted four major factors influencing customer experience with AI-powered WhatsApp Business Agents. AI Service Quality is the most important factor, followed by Customer Satisfaction and Engagement. The extracted factors explain **84.73% of total variance**, showing that these dimensions strongly influence customer perceptions.

6. Suggestions

- 1) Businesses can improve the performance of AI-powered WhatsApp Agents by making their responses more accurate and customer-friendly.
- 2) AI agents should be regularly updated with new information so that customers receive correct solutions without delay.
- 3) Companies should focus on creating more personalized conversations because customers prefer services that understand their needs.
- 4) Privacy and security features should be strengthened to build more trust among customers while using AI services.
- 5) Businesses can provide an option to connect with human customer support whenever AI cannot solve complex problems.
- 6) Customer feedback should be collected regularly to understand problems and improve AI service quality.
- 7) Companies can use AI tools along with human support to provide a smoother and more satisfying customer experience.

7. Conclusion

The study concludes that AI-powered WhatsApp Business Agents have a positive influence on customer satisfaction and engagement. Customers appreciate AI services because they provide quick responses, easy communication, and continuous support. The findings show that better AI service quality leads to improved customer experiences and stronger engagement with businesses.

AI-based customer support helps companies save time, improve communication, and build better relationships with customers. However, maintaining accuracy, privacy, and a balance between AI and human interaction is important for long-term success. Overall, AI-powered WhatsApp Business Agents can be considered an effective tool for improving customer service and enhancing customer satisfaction in the modern digital environment.

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Author Biographies



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Level of Risk Tolerance and Investment Awareness on Investment Behavior

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Abstract

The present study risk tolerance and investment awareness are key factors influencing investment behaviour. The data collected for the study were analysed using both descriptive and inferential statistical techniques. Descriptive statistics, including the mean and standard deviation, were used to summarize the respondents' demographic characteristics and the distribution of the study variables. Inferential statistical techniques such as correlation analysis, regression analysis, Analysis of Variance (ANOVA), and the independent samples t-test were employed to examine the relationships among the variables and to identify significant differences across demographic groups. Risk tolerance was measured using the Risk Aversion Scale, while investment behaviour was assessed using the Financial Management and Behavioural Scale (FMBS). Investment awareness was measured using a self-developed scale designed to evaluate respondents' knowledge and understanding of investment concepts. These statistical methods were used to test the study's hypotheses and to examine the influence of risk tolerance and investment awareness on investment behaviour.

Keywords: *Financial risk tolerance, investment awareness, investment behaviour, financial literacy, investment decision-making, investment experience, financial well-being*

1. Introduction

Investment behaviour forms a very crucial aspect when considering the financial performance of an individual in an increasingly complex financial system. While there are numerous avenues for investment, each having distinct characteristics in terms of risk tolerance and risk-taking capacity, there is also variation in terms of investment knowledge. Investors differ regarding their ability to tolerate various levels of uncertainty in investments; while some

are able to take risks, others prefer conservative approaches. Nevertheless, a significant percentage of investors are unaware of their personal risk tolerance level and also how to determine it. Consequently, such individuals may make poor investment decisions, leading to loss or conservative moves that would have earned more money. The second issue relates to the difference in investment awareness. Some investors lack sufficient knowledge regarding financial instruments, market dynamics, and various investment approaches. Such investors tend to make poor investment decisions, depend on informal sources of information and are likely to succumb to behavioural factors. The impact of risk tolerance and investment varies in influencing investor decisions leading to inconsistencies in investment behaviour. However, the extent of the influence of these two aspects on investment decisions is not clearly known.

2. Review of Literature

Financial risk tolerance has emerged as a crucial determinant of investment behaviour. Early studies by Grable and Lytton (1999) developed a reliable instrument for measuring financial risk tolerance and found that younger, highly educated, and higher-income individuals generally exhibit greater risk tolerance. Similarly, Faff, Mulino, and Chai (2008) examined the relationship between risk tolerance and risk aversion and observed that self-reported risk tolerance does not always align with actual investment behaviour, highlighting the complexity of investor decision-making. Recent studies further emphasize the importance of risk tolerance in shaping investment decisions. Amponsah et al. (2025) found that investors with higher risk tolerance prefer high-return, risky investments, while risk-averse investors choose safer options. Lathief et al. (2024) reported that risk tolerance significantly influences portfolio allocation decisions, particularly in emerging markets. Likewise, Sukmawati et al. (2025) identified risk tolerance as a significant predictor of Generation Z investment decisions, especially in IPO investments.

Financial literacy and investment awareness play a vital role in improving investment decisions. Mubaraq, Anshori, and Trihatmoko (2021) found that financial knowledge enhances investors' confidence and willingness to undertake investment risks, thereby improving decision-making quality. Mahat and Lau (2023) similarly reported that financially literate individuals demonstrate greater investment confidence and better investment behavior. Mandal et al. (2024) highlighted that financially literate working individuals possess higher investment awareness and are more likely to engage in informed investment activities. Tubastuvi et al.

(2024) found that financial literacy enables Generation Z investors to understand investment alternatives and make rational investment choices. Damayanti (2025) further confirmed that financial literacy positively affects investment decisions among Generation Z investors. Collectively, these studies indicate that increased financial knowledge and awareness contribute significantly to sound investment behavior.

Several studies have examined the influence of demographic and psychological factors on investment decisions. Roy and Singh (2024) identified age, gender, income, and education as important determinants of financial risk tolerance. Arora and Purohit (2024) also concluded that demographic characteristics and psychological factors significantly influence investment behavior.

Psychological attributes such as personality traits, emotions, and behavioral biases have been found to affect risk-taking behavior. Mukhtar and Jan (2023) reported that traits such as openness and extroversion increase risk tolerance, whereas neuroticism reduces investors' willingness to take risks. The Investor Psychology Study (2024) demonstrated that emotions, fear, overconfidence, and panic often lead investors to deviate from rational decision-making. Aras (2023) similarly argued that traditional economic theories fail to fully explain investor behavior because psychological influences often shape actual investment actions.

A growing body of literature focuses on generational variations in investment behavior. Rehmat and Magada (2025) observed that younger investors generally exhibit higher risk tolerance and are more willing to explore diverse investment opportunities than older investors. Thomas et al. (2024) found that Generation X investors tend to be conservative, Generation Y investors adopt a balanced approach, and Generation Z investors are more risk-oriented and technology-driven. Rosdiana et al. (2026) highlighted that Generation Z investors display higher risk tolerance and are strongly influenced by social media and digital platforms, whereas Millennials are comparatively cautious due to financial responsibilities. However, Marjerison et al. (2025) reported contrasting findings, suggesting that Generation Z investors often prefer safer investments due to economic uncertainties and limited investment experience. These mixed findings indicate the need for further research on generational investment behavior.

Technological advancements are increasingly influencing investment behavior. Rosdiana et al. (2026) identified technology utilization as a major determinant of investment decisions among younger generations. Marjerison et al. (2025) found that Millennials actively use technology for investment activities, while its influence on Generation Z is less pronounced. Emerging technologies such as artificial intelligence are also transforming investment decision-making. Li et al. (2025) proposed an AI-based personalized portfolio recommendation system that integrates large language models and reinforcement learning to optimize investment strategies according to investors' risk preferences. Cho, Bae, and Kim (2026) demonstrated that AI models can adapt investment decisions based on varying risk profiles and demographic characteristics. Furthermore, Du et al. (2025) emphasized the role of data visualization technologies in improving financial literacy and investment understanding.

The reviewed literature consistently demonstrates that financial literacy, investment awareness, and risk tolerance significantly influence investment behavior. However, existing studies primarily examine these variables independently or focus on specific demographic groups. Limited research has explored the combined effect of investment awareness and financial risk tolerance on investment behavior, particularly among different generations. Additionally, findings regarding Generation Z's risk-taking behavior remain inconsistent.

Therefore, further research is required to examine the integrated influence of investment awareness and financial risk tolerance on investment behavior across generational groups.

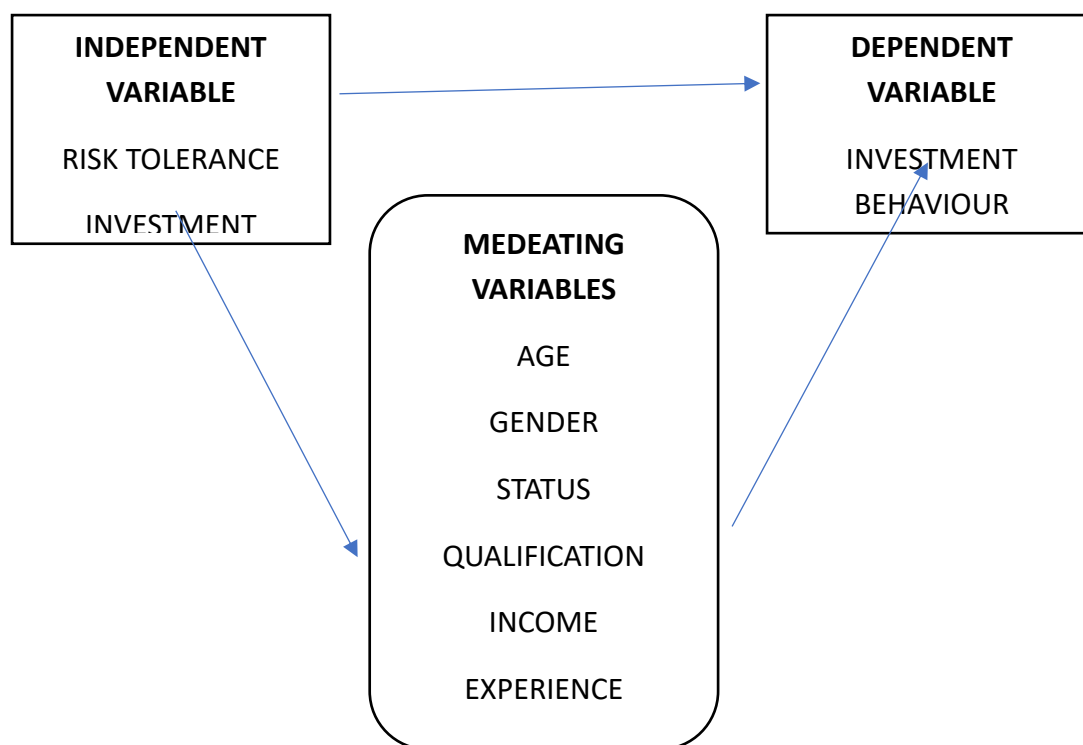
Based on this relationship between variables, hypotheses of the study were developed.

- H1: Risk tolerance is positively affecting investment behaviour.
- H1: Investment awareness has significant positive impact on investment behaviour.

3. Objective of the Study

- To examine the level of risk tolerance, investment awareness and investment behaviour.
- To know whether risk tolerance strengthen the relationship between awareness and investment behaviour.

4. Conceptual Model for Investment Behaviour



5. Research Design

The present study adopts a **quantitative research design** to examine the relationship between risk tolerance, investment awareness, and investment behaviour. The study is based on both **primary and secondary data**. Primary data were collected through a **structured questionnaire** administered to respondents, while secondary data were gathered from various published sources, including journals, books, reports, and relevant websites. The **population** for the study comprises the general public across Kerala. A total of **102 respondents** were selected as the **sample size** using the **convenience sampling method**, whereby participants were chosen based on their accessibility and willingness to participate in the survey. The collected data were analysed using **Statistical Package for the Social Sciences (SPSS)** software to examine the relationships among the study variables.

The study includes **risk tolerance** and **investment awareness** as the **independent variables**, while **investment behaviour** is considered the **dependent variable**. The analysis aims to assess the influence of risk tolerance and investment awareness on investment behaviour and to determine the statistical significance of these relationships.

The data collected for the study were analysed using both descriptive and inferential statistical techniques. Descriptive statistics, including the **mean** and **standard deviation**, were used to summarize the respondents' demographic characteristics and the distribution of the study variables. Inferential statistical techniques such as **correlation analysis**, **regression analysis**, **Analysis of Variance (ANOVA)**, and the **independent samples t-test** were employed to examine the relationships among the variables and to identify significant differences across demographic groups. **Risk tolerance** was measured using the **Risk Aversion Scale**, while **investment behaviour** was assessed using the **Financial Management and Behavioral Scale (FMBS)**. **Investment awareness** was measured using a **self-developed scale** designed to evaluate respondents' knowledge and understanding of investment concepts. These statistical methods were used to test the study's hypotheses and to examine the influence of risk tolerance and investment awareness on investment behavior.

6. Analysis and Interpretation

Correlation Analysis		RA	IB	IA
RA	Pearson Correlation	1	.337	-.189
	Sign. (2-tailed)		.001	.57
	N	102	102	102
IB	Pearson Correlation	.337	1	-.098
	Sign. (2-tailed)	.001		.329
	N	102	102	102
IA	Pearson Correlation	-.189	-.098	1
	Sign. (2-tailed)	.057	.329	
	N	102	102	102

Interpretation

From the correlation test, it is evident that there exists a moderately strong positive and statistically significant correlation between risk tolerance and investment behavior ($r=0.337$, $p=0.001$), showing that individuals with high risk tolerance have better investment behavior.

On the other hand, there exists a weak negative but statistically insignificant correlation between investment awareness and investment behavior ($r=-0.098$, $p=0.329$), showing that investment awareness does not play a critical role in shaping investment behavior. The same

can be said about the correlation between risk tolerance and investment awareness since there exists a weak negative but statistically insignificant correlation between them ($r=-0.189$, $p=0.057$)

Regression Analysis

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin Watson
1	.338 ^a	.114	.097	4.70136	1.808

Interpretation

Based on the output above, the model has a reasonable degree of explanatory ability. In terms of the strength of the association, since the R statistic equals 0.338, this denotes a low to moderate positive association between the variables. The coefficient of determination (R square) equals 0.114, implying that 11.4% of the variations in investment behavior can be attributed to the regression model. Similarly, an adjusted R square value of 0.097 indicates that 9.7% of the variations have been accounted for in light of the number of independent variables used. Moreover, the standard error of estimation amounts to 4.701, representing a moderate degree of prediction errors. Finally, the Durbin-Watson Tableure stands at 1.808, meaning there is no autocorrelation of the residuals since this statistic is near to 2.

ANOVA

Model	Sum of Square	df	Mean Square	F	Sig.
Regression	282.814	2	141.407	6.398	.002 ^b
Residual	2188.176	99	22.103		
Total	2470.990	101			

Interpretation

From the ANOVA output, the regression analysis appears to be statistically significant. According to the model, the F value of 6.398 with a significance value of 0.002 is below 0.05 meaning that the model is a good fit. Therefore, the independent factors, including risk

tolerance and investment awareness, significantly impact investment behavior. In addition, based on the regression sum of squares of 282.814 and the residual sum of squares of 2188.176, the results show that the model is capable of explaining some of the variances in the dependent variable.

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	9.933	3.218		3.086	.003		
	IA	-.063	.173	-.035	-.364	.716	.964	1.037
	RA	.298	.087	.330	3.425	.001	.964	1.037

Interpretation

According to the findings obtained, it is observed that risk tolerance (RA) plays an important role on investment behavior but investment awareness (IA) is not significant. From this, it is evident that the regression coefficients of risk tolerance ($B = 0.298$, $p = 0.001$) are statistically significant. This means that any change in the level of risk tolerance is followed by a corresponding change in investment behavior. On the other hand, investment awareness ($B = -0.063$, $p = 0.716$) plays no statistically significant role on investment behavior. The constant value of the two coefficients ($B = 9.933$, $p = 0.003$) is statistically significant. Moreover, in terms of collinearity statistics, it is seen that there are no issues related to multicollinearity as the values of tolerance (0.964) and VIF (1.037) are within an acceptable range.

Residual Statistics	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	10.5843	19.5941	13.9902	1.67336	102
Residual	-11.25698	11.94654	.00000	4.65458	102
Std. Predicted Value	-2.035	3.349	.000	1.000	102
Std. Residual	-2.394	2.541	.000	.990	102

Interpretation

According to the residual statistics, the fitted regression line appears to be adequate. The predicted values fall in the range of 10.58 and 19.59 with a mean value of 13.99. Therefore, there is some variation in the predicted values of investment behavior scores. The mean of the residuals is 0.000, which shows that the error is normally distributed. The standard deviation of the residuals is 4.654, which suggests that there is some variation in the error terms used to predict investment behavior scores. The standardized predicted values range from -2.035 to 3.349, whereas standardized residuals vary between -2.394 and 2.541, both of which lie in the range of ± 3 . Thus, the data does not contain any significant outlier.

7. Findings

The results of the study indicate that **risk tolerance has a positive and significant influence on investment behavior**. The correlation analysis revealed a positive relationship between risk tolerance and investment behavior ($r = 0.337$), while the regression analysis further confirmed that risk tolerance significantly predicts investment behavior ($B = 0.298$, $p = 0.001$). These findings suggest that individuals with higher levels of risk tolerance are more likely to exhibit favorable investment behavior by making informed and confident investment decisions. Therefore, the study concludes that an increase in risk tolerance leads to an improvement in investment behavior. Based on these findings, the hypothesis **H1: High risk tolerance positively influences investment behavior** is accepted.

The results of the study indicate that **investment awareness does not have a significant influence on investment behavior**. The correlation analysis revealed a weak negative relationship between investment awareness and investment behavior ($r = -0.098$), while the regression analysis showed that the effect of investment awareness on investment behavior was statistically insignificant ($B = -0.063$, $p = 0.716$). These findings suggest that merely possessing investment knowledge or awareness does not necessarily translate into positive investment behavior. Other factors, such as risk tolerance, financial experience, or behavioral characteristics, may play a more important role in influencing investment decisions. Therefore, the hypothesis **H2: Investment awareness has a significant positive effect on investment behavior** is rejected.

The correlation analysis was conducted to examine the relationships among risk tolerance, investment awareness, and investment behavior. The findings indicate that **risk tolerance is the key factor influencing investment behavior**, showing a positive association with investors' decision-making and financial actions. Individuals with higher levels of risk tolerance are more likely to exhibit favorable investment behavior. In contrast, **investment awareness does not demonstrate a significant relationship with investment behavior**, suggesting that awareness or knowledge of investment concepts alone is insufficient to influence actual investment decisions. These results imply that behavioral characteristics, particularly an individual's willingness to accept financial risk, play a more critical role in shaping investment behavior than investment awareness alone.

8. Suggestions

The findings of the study suggest the need for greater emphasis on improving financial literacy among individuals, as possessing investment knowledge alone is insufficient unless it is effectively translated into sound investment practices. Financial institutions, educational institutions, and policymakers should develop targeted financial education programs for young and inexperienced investors to enhance their understanding of investment risks, build confidence, and encourage informed investment decisions. Greater exposure to practical investment activities through simulations, workshops, internships, and market-based learning experiences should also be promoted, as practical experience plays a vital role in shaping positive investment behaviour. Furthermore, the investment awareness scale used in the study may be refined by improving weaker items and incorporating additional dimensions, particularly those related to risk perception and financial decision-making. Future research should include a larger and more diverse sample comprising respondents from different age groups, income levels, educational backgrounds, and investment experience to improve the generalizability of the findings. Finally, young individuals should be encouraged to begin investing at an early stage through the use of digital investment platforms, educational initiatives, and simulation-based learning, thereby fostering responsible financial habits and long-term wealth creation.

9. Conclusion

The current research will conduct an exhaustive examination of the connection between risk aversion, investment knowledge, and investment behavior, as well as their link to the

chosen demographic variable. The results show that investment experience and age are the two critical factors that affect risk aversion and investment behavior because people who are more experienced and older are associated with lower risk aversion and more investing. On the other hand, demographic factors like gender, marital status, education level, and monthly salary are not statistically significant for explaining the above-mentioned variables, which implies that people form their opinions regarding investments mostly based on their experience rather than demographic factors. Another finding of the research is that investment awareness is stable among respondents and shows some level of knowledge about finances, but it does not affect actual investing, which leads to the conclusion that people are aware of investment opportunities but lack the skills to implement them in practice. Finally, the reliability test shows that the measuring instruments used in the research are statistically valid and reliable. One should also note that the sample mainly consists of younger, poor, and inexperienced people and, therefore, provides information. From the overall discussion in the study, it becomes clear that experience-based learning and exposure are vital to make people improve their investing behavior and overcome their risk aversion attitude since mere awareness is not enough, which highlights the necessity of adopting an integrated approach to financial education.

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Customer Perception of FMCG Goods in Thoothukudi District

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Abstract

The Fast-Moving Consumer Goods (FMCG) industry in India is rapidly growing, primarily driven by urbanization, increasing disposable incomes, and evolving consumer preferences. This study aims to examine the consumer behaviour and perceptions towards FMCG products in the Thoothukudi District of Tamil Nadu. The research investigates the socio-economic profile of consumers, their satisfaction levels with FMCG products, and the key factors influencing their purchasing decisions, including brand loyalty and knowledge. The study also delves into the distinct segments of FMCG goods, such as food and beverages, personal care, and household care, and their growth patterns in the region. Additionally, family size and educational levels play a significant role in influencing consumer choices. The study highlights that quality is a primary determinant of purchase decisions, with brand loyalty also being a significant factor. Recommendations for FMCG companies include improving product quality, ensuring consistent hygiene standards, and tailoring marketing strategies to meet the evolving consumer demands. This study underscores the critical role of understanding consumer perceptions in driving sales and sustaining market growth in the competitive FMCG sector.

Keyword: FMCG, Consumer Behaviour, Consumer Perception, Brand Loyalty, Product Quality, Consumer Satisfaction

1. Introduction

Due to the ease of obtaining imported raw materials and low labour costs, India is emerging as one of the most alluring markets for international FMCG companies. With

around two-thirds of the overall revenues, the urban segment is the largest contributor to the growth of the FMCG sector in India. One of the main drivers of India's GDP development is the fast-moving consumer goods (FMCG) industry. Consumer packaged goods are another name for FMCG products. Fast Moving Consumer Goods (FMCG) are items with a rapid turnover and comparatively low cost. Over three million people are employed in downstream activities by India's FMCG sector, which is the country's fourth largest economic sector. Household care, personal care, and food and beverages are its main components. A well-established distribution network, low penetration rates, low operational costs, reduced per capita consumption, and fierce competition between the organized and unorganized segments are characteristics of the FMCG industry. Toilet soaps, detergents, shampoos, toothpaste, shaving products, shoe polish, packaged foods, domestic accessories, and some technology items are the most often listed items.

2. Statement of the Problem

Products that are sold swiftly and at a reasonable price are known as fast-moving consumer goods, or FMCG. The total income from these products might be high because the profit from them is very small and they are sold in huge quantities. Due to intense competition, fast-moving consumer goods manufacturers are compelled to find creative ways to generate revenue. They achieved this by identifying the common demands and purchasing motivations of the consumer and creating a solution. Customers have diverse demands, different prospects, and drastically different living standards and lifestyles, which makes this extremely challenging. Customers are more active these days, and their tastes and preferences are evolving.

When choosing their fast-moving consumer items, consumers are encountering a number of issues. Knowing how consumers see a company's goods, services, or overall operations is crucial for any business. Customers' opinions have an impact on the company's goods and services. In order to improve the store in areas where customers have negative impressions, this study aims to comprehend customer perceptions. Since it is a component of selling, determining customer perception becomes quite difficult. Given this context, it is clear that more research is required in the area of FMCG consumer behaviour in the Thoothukudi District.

3. Objectives of the Study

1. To examine the sample respondents' socio-economic standing.
2. To determine respondents' general satisfaction with FMCG products.
3. To determine the elements affecting consumer decision-making and purchasing behaviour.
4. To investigate how consumers view FMCG product brand knowledge and brand loyalty.

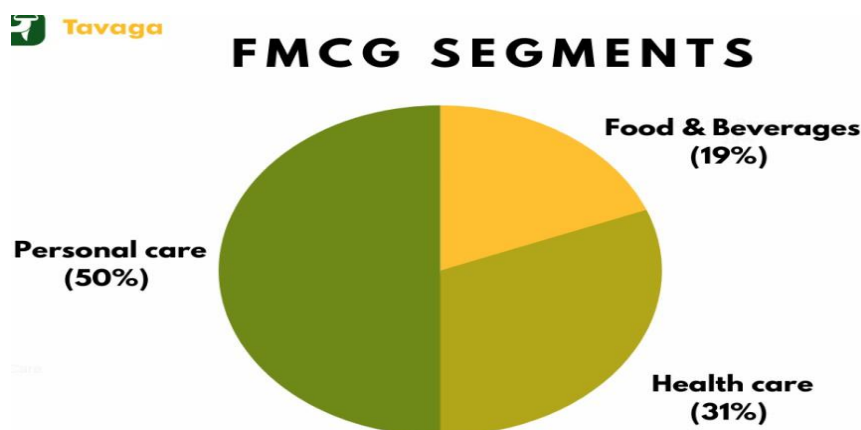
4. Need for the Study

The fast-moving consumer goods (FMCG) industry has grown significantly in the twenty-first century, and there is a great need to understand consumer behaviour toward FMCG products in the Thoothukudi District of south Tamil Nadu. Business growth is dependent on customer satisfaction; when customers are satisfied, business growth in terms of sales would gradually increase.

Figure:1 Power of FWCG



Figure:2 Segments of FMCG Goods



1. Food and Beverages

The food and beverage industry has grown in recent years due to the shifting tastes of urban upper middle class families. India has the potential to become the biggest participant in the food and agricultural sectors and is currently the second-largest food producer in the world, after China. The cuisine One of India's biggest industries, the processing sector is placed fifth in terms of production, consumption, exports, and anticipated growth. It makes up 19% of the industry. Health drinks, staples, cereals, baked goods, chocolates, ice cream, tea, coffee, soft drinks, processed fruits and vegetables, dairy products, and branded flour are all included in this category.

2. Personal care Product

The main segments of the personal care market include hair care, skin care, colour cosmetics, perfumes, and personal hygiene items like deodorants and bath and shower products. Every one of these segments displays distinct growth patterns and trends. Future demand for personal care products, particularly those with active ingredients, is expected to be high due to favourable demographic considerations and rising public awareness. It makes up 31% of the industry. OTC and ethical products are included in this category.

3. House Hold Care

Household cleaners and fabric washes make up the majority of this category. There is fierce rivalry in this market category, which is driven by volume and has low margins. It makes up half of the industry. Oral, hair, and skin care, cosmetics and deodorants, perfumes, feminine hygiene and paper products, fabric wash, and domestic cleansers are all included in this section. To boost their sales value, laundry care, air care, and toilet care companies have introduced variations of their standard products with extra features including aroma, germ-fighting properties, improved cleaning, and packaging.

Table – 1 Socio Economic Profile of the Respondents

Basis	Variables	No. of Respondents	Percentage
Gender	Male	61	61
	Female	39	39
	Total	100	100

Age	Below 20	23	23
	21 – 40	62	62
	41 – 60	10	10
	Above 60	5	5
	Total	100	100
Occupation	Agriculturist	11	11
	Salaried class	79	79
	Others	10	10
	Total	100	100
Monthly Income	Below Rs.20,000	58	58
	Rs.20,000-Rs.40,000	22	22
	Rs.40,000-Rs.60,000	15	15
	Above Rs.60,000	5	5
	Total	100	100
Size of the family	Below 3	20	20
	3 -5	70	70
	Above 5	10	10
	Total	100	100
Educational Qualification	Illiterate	10	10
	Higher secondary	15	15
	Under Graduate	50	50
	Post Graduate	25	25
	Total	100	100

5. Findings

1. The sample group consists of more male members 61%.
2. 62% belongs to the age group of 21-40 years.
3. 70 per cent of the respondents belong to 3 to 5 members in the family.
4. As far as the family size 70 per cent of the respondents belong to 3 to 5.
5. 65 % are married and having a good occupational background.
6. 79 % are salaried people, high level of literacy 50% are graduates.
7. Among them 60% from nuclear family.
8. 65% hail from rural area while 35 % from urban area.

9. With regard to income generation 58 % earned a monthly income of below Rs.20,000

6. Suggestions

According to the analysis, consumers in various FMCG market categories had varying opinions on the source of their purchases. As a logical consequence of the study, the researcher would like to offer some advice and recommendations to distributors and manufacturers regarding more successful marketing tactics that they should employ in order to meet consumer expectations for a dynamic FMCG market. The majority of these recommendations are based on the study's findings, while others are based on the researcher's general and individual experiences. It is intended that if these suggestions are implemented, the general public, the business community, and society as a whole will all gain.

To preserve their reputation in the market, the companies producing the goods should guarantee the quantity and quality of the goods contained in the packages or containers. All businesses that manufacture FMCG goods must attempt to sway consumers in a manner that complies with legal requirements in order to maintain their market share. Following a thorough research program, the items must be continuously improved, but not at the expense of quality and hygiene.

7. Conclusion

The study comes to the conclusion that buyers' perceptions of fast-moving consumer goods, specifically with regard to Thoothukudi District. According to this perspective, the researcher has drawn conclusions and recommendations from the study. The study claims that the packaging has no bearing on the FMCG products' brand value. Product pricing and promotion. However, it is thought that consumers purchase FMCG products depending on their quality. They think that as consumers are happy with the branded items' quality, more FMCG products will be purchased if they are of high quality. Because sanitation and health are crucial to the expansion of FMCG products, producers and after undergoing numerous testing, suppliers should take great care to provide high-quality FMCG products, particularly food items and skin care items. Unless the customers are delivered high-quality goods at competitive prices, FMCG products would not be able to endure in the market going forward.

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The Growth of Digital Taxation in India in The Post-GST Regime: A Study

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Abstract

The adoption of the goods and services tax (GST) on July 2017 marked a dramatical transformation in India's indirect taxation system. One of the important outcomes of GST has been the advancement of a technology- driven digital taxation system that has steamed the digitalized tax administration across the country. Digital taxation under GST contains online registration, return filing, tax payment systems, e- invoicing and electronic monitoring techniques that promotes transparency and efficiency. The study seeks to examine the growth of digital taxation after GST adoption in India and analyze the value addition of digital platforms such as e-filing systems, GST Network (GSTN) and e- invoicing in strengthening tax compliance and openness. The Study is descriptive in nature and relies wholly on Published data collection from government records, GST council records, RBI records, research papers and economic Surveys. The Findings reveal substantial growth in digital taxation administration, improved tax compliance, increased revenue collection and compliance complexities continue to continue. Altogether, GST has prominent contribution to India's Transition towards a digitally enabled taxation Eco system.

Keywords: GST, Digital taxation, Digital Economy, Tax administration

Introduction

The adoption of the goods and services tax (GST) on 1st July 2017 marked a notable milestone in India’s tax reform journey. It is one of the highly comprehensive indirect tax reforms in the country, GST switched several taxes, including value added tax (VAT), Excise Duty, Service Tax and Central Sales tax with a single unified taxation system. This reform was introduced to ease the Tax structure, reduce complexities and increase the overall economic productivity.

The major outcomes of GST implementation have been the expedited adoption of digital taxation approaches. Within the framework of GST regime, various tax- related activities such as taxpayer registration, return filing, tax payments, invoice generation and compliance tracking are carried out through digital platforms. This shift has transformed the way business and tax authorities interact, making tax administration more easily accessible.

The digitalization of taxation has considerably reduced reliance on manual procedures while improving transparency, accountability and operational efficiency. Technological platforms such as the GST network (GSTN), e-invoicing systems and electronic return filing framework have strengthened tax administration and contributed to minimizing tax evasion. Additionally, the move toward digital taxation supports India’s broader vision of a digital India economy by promoting technology-driven governance, enhancing financial transparency and encouraging greater compliance within the taxation system.

Review of Literature

S. No	Author(s) & Year	Title/Focus	Key Findings/Contributions
1	Dikshit et al. (2022)	Taxation transformation of businesses enabled by information systems: GST implementation in India	Empirically established that information systems played a pivotal role in enabling taxation transformation; digital infrastructure underpins GST compliance for businesses

2	Kurtkoti & Gapat	Impact of digital compliance under India's GST on tax revenue and economic growth	Examined how digital compliance under GST directly influences tax revenue generation and overall economic growth
3	Dandona (2025)	Impact of Digital Payments on GST Revenue in India	Traced the specific contribution of digital payments to GST revenue generation; highlighted the role of cashless transactions in broadening the tax base
4	Sreesankar & Durgalashmi (2025)	Digital Transformation in GST: A Comparative Study of Tax Compliance Systems in South Indian States	Conducted a comparative analysis of GST compliance systems across South Indian states; reinforced the importance of digital transformation in tax administration
5	Kaur & Khanna (2024)	A Comparative Study of Pre GST and Post GST Scenarios – A Revolutionary Digital Step Towards Digitalisation in India	Contrasted pre- and post-GST scenarios; underscored the revolutionary shift toward digitalization in India's taxation system
6	Kumar (2025)	Tax Reforms and Revenue Generation: A Case Study of the Indian GST System	Situated GST within broader tax reform narratives; analyzed its role in enhancing revenue generation and improving fiscal efficiency
7	Thirupathi & Devanna	The GST Revolution: Transforming India's Economic Landscape – A Comprehensive Review	The study provides a comprehensive overview of the transformative impact of GST on India's economy. It highlights how GST has streamlined the taxation system, promoted economic integration, and contributed to long-term structural reforms.

8	Sharma & Sharma (2026)	Impact of GST on Small and Medium Enterprises (SMEs) in India	The authors examined the effects of GST on SMEs and found that while the new tax regime created initial compliance challenges, it also offered opportunities for improved market access, transparency, and business growth.
9	Halder et al. (2026)	Impact of GST on Economic Development in the Era of Digital India	This study explored the role of GST in supporting economic development within the Digital India framework. The findings emphasize that GST-driven digitalization has enhanced transparency, efficiency, and alignment with national development objectives.
10	Joseph & Ramalingam (2021)	Digital Payments and GST Revenue: An Empirical Analysis Empirically	The study empirically investigated the relationship between digital payment adoption and GST revenue collection..

Objectives of the Study

1. To analyze the growth of digital taxation systems after the implementation of GST in India.
2. To examine the role of GST digital platforms such as GSTN, e-filing systems, and e-invoicing mechanisms in improving tax compliance and transparency.

Research Methodology

The present study is descriptive and analytical in nature and is based entirely on secondary data sources.

Sources of Data

The data for the study have been collected from:

- GST Council Reports
- Ministry of Finance Publications
- GST Network (GSTN) Portal

- Reserve Bank of India (RBI) Reports
- Central Board of Indirect Taxes and Customs (CBIC) Data
- Economic Survey of India
- Research papers from Google Scholar and ResearchGate
- Newspapers and government publications

The collected information has been analyzed to understand trends and developments in digital taxation after GST implementation.

Concept of Digital Taxation under GST

Digital taxation refers to the application of technology-based systems for administering tax processes efficiently and transparently.

Under GST, digital taxation includes:

- Online GST registration
- E- filing of GST returns (GSTR-1, GSTR-3B, etc.)
- E-invoicing systems
- E-way bill systems for transportation of goods
- Online tax payment facilities
- Automated tax compliance monitoring
- Digital refund processing systems

These initiatives reduce manual intervention and increase operational efficiency.

Growth of Digital Taxation after GST Implementation

Increase in Registered Taxpayers

Following GST implementation, India witnessed a substantial rise in registered taxpayers. The centralized digital registration mechanism enabled businesses across sectors to participate in the formal tax ecosystem.

Complete Transition toward E-Filing

GST has introduced a wholly digital return filing mechanism. Businesses now submit tax returns electronically through the GSTN portal, reducing paperwork and administrative delays.

Expansion of E-Invoicing Systems

E-invoicing has significantly enhanced transaction transparency. The system allows real-time invoice validation and reduces the possibility of fraudulent tax practices.

Growth in Digital Tax Payments

GST payments are processed through internet banking, Unified Payments Interface (UPI), and other electronic payment systems. This has strengthened transparency and improved revenue tracking.

Enhanced Compliance Monitoring

Digital tools enable tax authorities to monitor transactions effectively, identify discrepancies, and minimize tax evasion.

Impact of Digital Taxation

Positive Impacts

The implementation of digital taxation has generated several benefits:

- Increased transparency in taxation procedures
- Reduction in tax evasion
- Faster processing of returns and refunds
- Improved government revenue collection
- Better documentation and record maintenance
- Greater accountability within tax administration
- Simplified compliance mechanisms

Issues and Constraints

Despite its advantages, certain challenges remain:

- Technical glitches in GST platforms
- Compliance burden for small businesses and MSMEs
- Limited digital literacy in rural regions
- Dependence on internet infrastructure
- Complexity in understanding compliance procedures

Role of Technology in GST Administration

Technology provides as the foundation of GST digital taxation.

Most important technological components include:

GST network (GSTN)

Acts as the Technological backbone for tax administration and information management.

E – Invoicing Systems

Enhance real – time invoice authentication and reduce fraudulent practices.

Data Analytics tools

Support fraud detection and compliance tracking

Automated return matching Systems

Improve tax verification efficiency and reduce manual errors

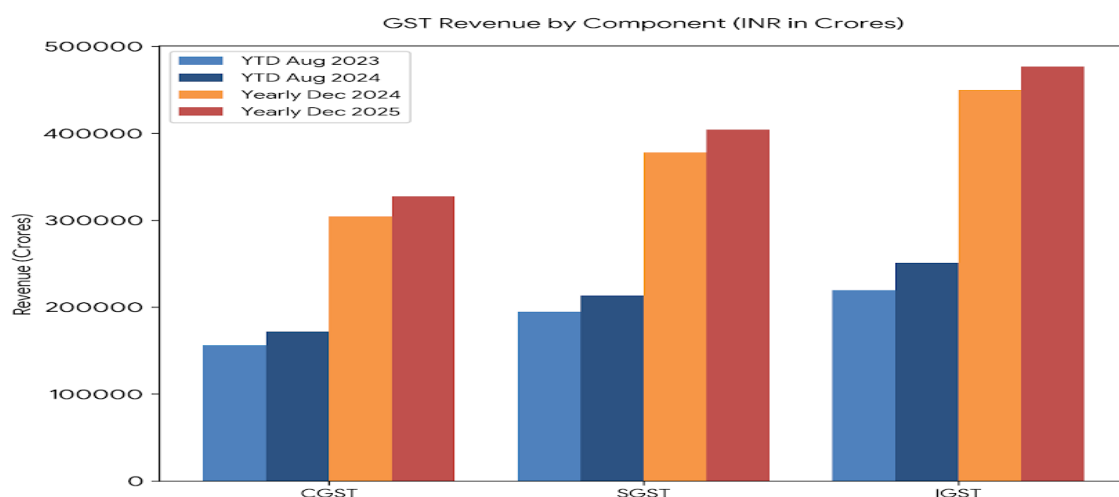
Cloud -based data Storage

Ensures safeguarded management and availability of tax information.

It has been integration strengthened transparency, operational effectiveness and consistency within India's taxation digital system.

Analysis of Research Findings

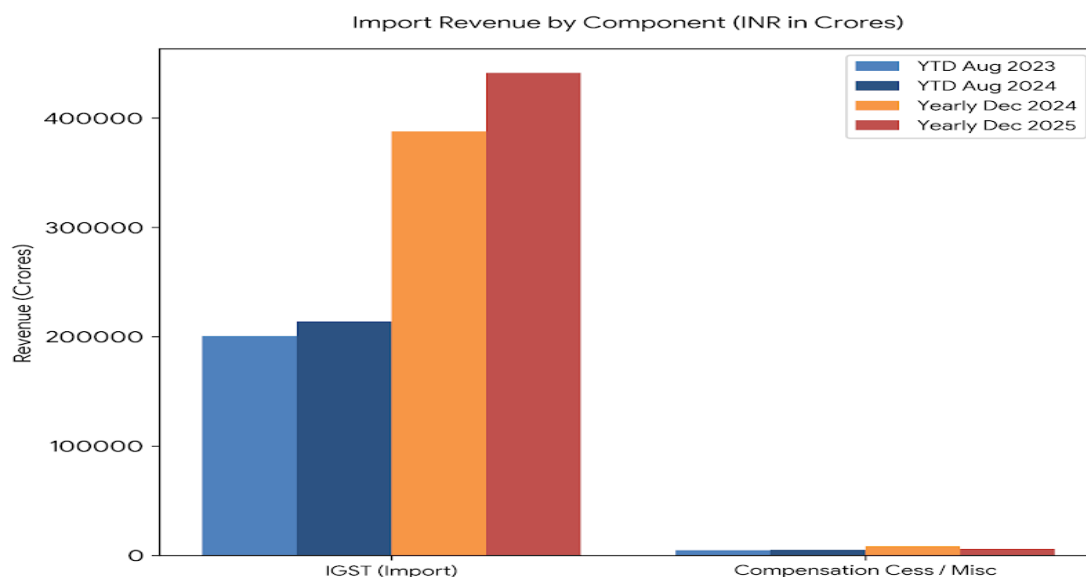
a. Analysis of Domestic Revenue



The graph indicates the steady growth of increase in GST revenue from all the three Components namely CGST (Central Goods and Services Tax), SGST (State Goods and

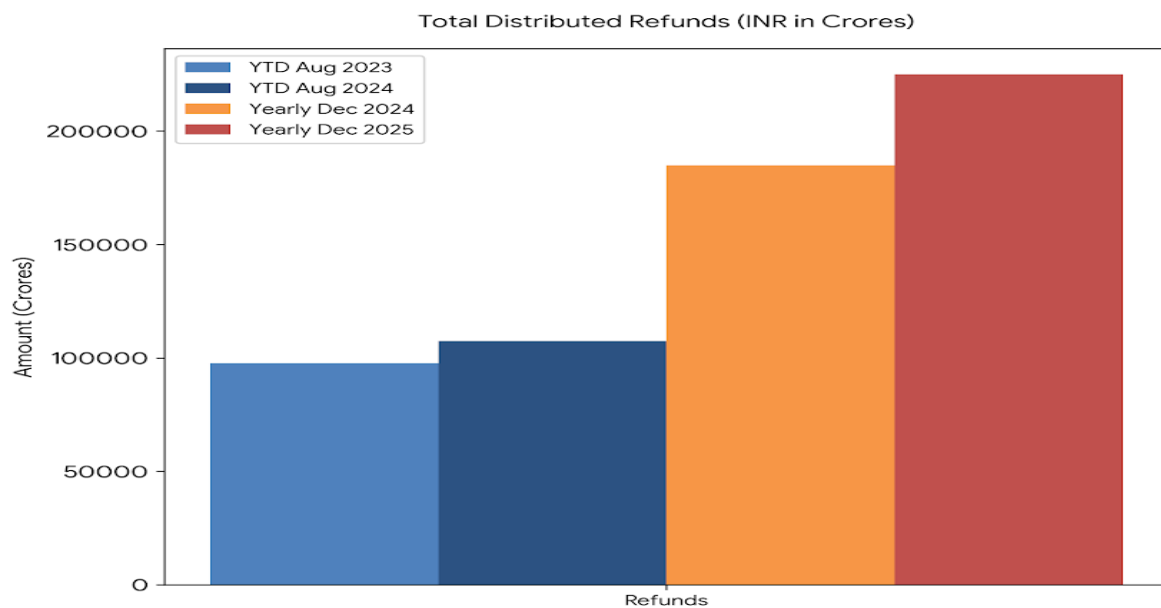
Services tax) and IGST (Integrated Goods and Services Tax) from 2023 to 2025, indicating the positive impact of the digital taxation system after adoption of GST. From the above, IGST displays the highest growth, increasing from approximately ₹2.19 lakh crore in August 2023 to nearly ₹4.77 lakh crore by December 2025. The data reveals that interstate trade, imports and digital business transactions. Along with IGST, CGST & SGST also increased significantly, increased in domestic tax collection and better coordination between the central and state governments. This shows that digital taxation has indicated the growth of e-invoicing, online, GST return filing, digital payments and automated monitoring system have reduced the burden to the tax payer and tax evasion. Overall, the graph shows that the adoption of GST has modernized India's taxation system, promoted economic formalization and contribution to the growth of a transparent and technology-driven digital tax infrastructure.

b. Analysis of Import Revenue



The graph indicates a considerable increase in GST revenue generated from imports between 2023 and 2025, with Integrated Goods and Services Tax (IGST) accounting for the largest share of growth. IGST collections on imports increased significantly from approximately ₹2.00 lakh crore in August 2023 to around ₹4.41 lakh crore by December 2025. The going up trend reflects a major expansion in taxable imports, international taxation and interstate trade activities. It also analysis compensation Cess and miscellaneous revenue remained small throughout the period, contributing only a minor share to total import revenue. This data shows that IGST has major source of GST revenue from imports.

C. Analysis of Distributed Refunds



The graph depicts a continuous increase in the total distributed GST refunds from 2023 to 2025, rising from nearly ₹97,651 crores in August 2023 to around ₹2,25,033 crores by December 2025. The stable growth in refund distribution informs that the GST system has become more effectively in processing and releasing tax refunds to businesses and taxpayers. The sharp increase observed between 2024 and 2025 indicates the expansion of taxable economic roles and the continued growth of GST collections under India's digital taxation framework. This upward trend indicates the increasing effectiveness of GST in capturing economic transactions and enhancing revenue generation.

Discussion

The findings of the study shows that the adoption of the Goods and Services Tax (GST) on:

- Among CGST, SGST and IGST- the tax collection for the period 2023-2025 is overtaken by IGST that from ₹2.19 lakh crore to August 2023 to nearly ₹4.77 lakh crore, this is great success of GST and Digital taxation System in India. This is also indicated that the collection of tax between states have more than CGST and SGST. Even though the CGST & SGST has slightly less than IGST, but contributing to Domestic tax collection. the above three components help the both the government namely State government and central government, it shows the coordination among them also. The tax collection also emphasis the digitalization improves the e- invoicing, online GST return filing, digital payments and automated monitoring system.

- Another important finding is international taxation that is import related GST revenue is improved from ₹2.00 lakh crore in August 2023 to around ₹4.41 lakh crore by December 2025. This is a major role of Digital taxation system in India the data proves that GST is not only Helped to get revenue in domestic but also improves overseas taxation system also.
- One more finding of the study is refund distribution among the tax payers, the greatest success of GST is ITC, the credit refund in 2023 to 2025, rising from nearly ₹97,651 crores in August 2023 to around ₹2,25,033 crores by December 2025. This demonstrates the weightage of Digital taxation system in India. The tax payers getting their refund within stipulated time due to the digitalization of indirect tax system. This is remarkable highlights of digital taxation.

Conclusion

The study indicates the major reforms in digital taxation system. The findings strongly suggests that implementation of GST and Digital Taxation has been done tremendous growth in the indirect taxation system. It has proven data that indicate, in the past eight years the digital taxation system is better day by day, by increasing it efficiency and effectiveness. The digital taxation system has made more robust in various areas like GST registration, e- invoicing, refunds and tax compliance. By reducing the cascading effects and automation helped the various stakeholder to do the business ease. In spite various struggles still digital taxation system is helping government to Collect tax and align with international taxation system also. In one word GST is process and it has followed its own progress also.

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Exploring Cyber Security Awareness and Digital Fraud Prevention Practices among Banking Customers in Bengaluru

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Abstract

The fast growth of digital banking services has transformed the banking sector by providing customers with accessible, fast, and reachable financial transactions. But, the increased use of online banking, mobile banking, UPI transactions, and digital payment programs has also led to a rise in cyber security dangers and digital fraudsters. This study focuses on customer awareness towards cyber security and digital fraud in banking services with special reference to Bengaluru. The research goals to explore the level of awareness among banking customers regarding cyber threats, online frauds, phishing attacks, OTP scams, identity theft, and safe digital banking systems. The study also examines the safeguards adopted by customers to protect their financial information and evaluates the role of banks in creating cyber security awareness. Primary data is collected through a structured questionnaire from finance customers in Bengaluru. The findings of the study are expected to highlight the importance of cyber security education, customer caution, and effective preventive measures in reducing digital banking frauds. The study determines that expanding customer awareness and adopting secure banking practices are essential for ensuring safe and consistent digital banking service sector.

Keywords: Cyber Security, Digital Fraud, Banking Services, Customer Awareness, Online Banking, Mobile Banking, Phishing, OTP Fraud, Digital Payments, Financial Security, Cyber Crime.

Introduction

The rapid growth of digital technologies has transformed modern business operations across commerce and management sectors.

India has experienced a dramatic shift toward digital banking after the introduction of UPI, internet banking, and mobile-based financial services. The convenience of instant digital payments has increased financial inclusion and customer satisfaction. However, the growing dependence on digital systems has also created opportunities for cybercriminals to exploit users through phishing attacks, OTP fraud, fake banking applications, social engineering, and malware-based attacks.

According to recent RBI records, digital payment frauds constitute a major share of banking fraud incidents in India. Bengaluru only witnessed cybercrime losses exceeding ₹4,100crore in current years, primarily due to phishing, online payment fraud, and digital arrest scams.

The increasing style of cybercriminals has made cyber security awareness an essential component of financial security. Many customers continue to share private banking details such as OTPs, CVV numbers, and passwords without understanding the risks involved. Hence, customer education and institutional cyber security measures have become critical for reducing financial fraud.

This study aims to investigate how cyber security awareness influences fraud prevention among digital banking users in Bengaluru.

Literature Review

The rapid expansion of digital banking in India has exposed customers to escalating cyber threats and financial fraud. Agarwal and Gupta (2021) surveyed 320 urban bank customers across metropolitan cities including Bengaluru and found that a significant proportion lacked awareness of phishing, vishing, and smishing attacks. Their study further established that educational qualifications and prior digital banking experience were key determinants of cybersecurity awareness, with public sector bank customers demonstrating notably lower awareness than their private sector counterparts. Similarly, Sharma and Patel (2020) applied the Technology Acceptance Model (TAM) to study 280 internet banking users in Bengaluru and found that perceived security risks deterred mobile banking adoption. They critically observed that despite rising fraud incidents, customers continued sharing OTPs and

using unsecured networks — a reflection of low risk literacy and overconfidence in bank security systems.

From a regulatory standpoint, Krishnamurthy (2019) examined the adequacy of RBI guidelines on customer protection and found that while the regulatory framework has evolved, grassroots awareness dissemination — particularly in Tier-1 cities like Bengaluru — remains insufficient. The study recommended integrating cybersecurity modules into bank onboarding processes. Balancing this, Reddy and Nair (2022) examined how demographic variables such as age, income, and digital knowledge shape fraud exposure in Karnataka. Their mixed-methods study revealed that senior citizenry and less-income customers were disproportionately sensitive to social engineering and fraudulent UPI transactions, emphasizing the need for demographically targeted awareness works.

Internationally, Mukherjee and Das (2023) directed a cross-national reasonable study of banking customers in India and Singapore, finding that Indian customers were more prone to digital fraud owing to insufficient cybersecurity training and institutional communication gaps. Their research exhibited that behavioural nudges such as real-time fraud alerts and contextual transaction warnings significantly developed customer vigilance in Singapore, offering a replicable model for Indian banks. Collectively, the reviewed literature establishes that cybersecurity awareness among banking customers in Bengaluru remains inconsistent, necessitating the present empirical investigation.

Research Gap

Even though the growing body of literature on cybersecurity awareness and digital fraud in Indian banking, significant research gaps remain. Existing studies have largely focused on metropolitan cities at a macro level, with limited attention to Bengaluru as a distinct urban banking ecosystem categorised by its unique demographic composition of tech-savvy professionals, senior citizens, and migrant workers. Moreover, while prior studies have examined awareness levels in separation, few have simultaneously explored the relationship between awareness, behavioural intention, and actual self-protective practices among banking customers in a single combined framework. Studies such as Agarwal and Gupta (2021) and Reddy and Nair (2022) offer valuable insights but do not holistically address how institutional communication strategies adopted by banks performing in Bengaluru influence customer

awareness outcomes. Additionally, the rapid abundance of UPI-based fraud and deepfake-enabled financial scams post-2021 has not been adequately addressed in the existing literature, representing a time-based gap. This study seeks to bridge these gaps by focusing specifically on Bengaluru, employing a structured questionnaire to assess awareness levels, and inspecting the role of bank-led awareness initiatives in shaping customer actions towards digital fraud prevention.

Objectives of the Study

1. To examine the degree of customer awareness towards cyber security threats and digital fraud in banking services among bank customers in Bengaluru.
2. To identify the types of digital frauds most generally encountered by banking customers in Bengaluru and the frequency of such occurrences.
3. To analyse the shape of socio-demographic factors such as age, gender, educational qualification, and income on the level of cybersecurity awareness among banking customers.
4. To evaluate the effectiveness of awareness programmes and communication strategies adopted by banks in Bengaluru towards training customers on cybersecurity and digital fraud prevention.
5. To suggest policy recommendations and strategic measures for improving customer awareness and self-protective behaviour against digital fraud in Bengaluru's banking sector.

Analysis and Interpretation

The following portion presents a efficient analysis and interpretation of the primary data collected from 91 respondents in Bengaluru through a designed Google Forms questionnaire. The data is organised question-wise, with each answer set analysed and interpreted to draw meaningful awareness related to customer awareness of cyber security and digital fraud in banking services.

5.1 Age Group of Respondents

Age	No. of Respondents	Percentage (%)
Below 18	~3	~3.3%

Age	No. of Respondents	Percentage (%)
18 – 25	77	84.6%
25 – 45	10	11.0%
45 – 60	~1	~1.1%
Total	91	100%

Analysis: The data reveals that 84.6% of the respondents belong to the 18–25 age group, denoting that the sample is predominantly composed of young adults who are digitally active banking users in Bengaluru.

Interpretation: The domination of young respondents suggests a high level of digital banking exposure among the youth in Bengaluru; however, it also underscores the need to examine whether this age group's digital skill translates into adequate cyber security awareness.

5.2 Gender of Respondents

Gender	No. of Respondents	Percentage (%)
Female	44	48.4%
Male	47	51.6%
Total	91	100%

Analysis: The gender division of the respondents is almost equal, with 51.6% male and 48.4% female members, displaying a compared representation in the study.

Interpretation: The near-equal gender split ensures that the results of this study are not unfair towards any one gender and provides a more holistic acknowledging of cyber security awareness across male and female banking customers in Bengaluru.

5.3 Awareness of Cyber Safety Risks in Digital Banking

Response	No. of Respondents	Percentage (%)
Yes	76	83.5%
No	15	16.5%
Total	91	100%

Analysis: A majority of 83.5% of respondents verified that they are aware of cyber security risks associated with digital banking service sector, while only 16.5% reported being ignorant.

Interpretation: While the extreme awareness rate is cheering, the remaining 16.5% who are uninformed represent a susceptible segment that is at considerable risk of dropping object to digital banking fraud, demanding targeted awareness by banks and regulators.

5.4 Most Repeatedly Used Banking Service

Banking Service	No. of Respondents	Percentage (%)
UPI Transactions	58	63.7%
Mobile Banking	18	19.8%
Internet Banking	8	8.8%
ATM Services	7	7.7%
Total	91	100%

Analysis: UPI Transactions occurred as the most generally used banking service with respondents at 63.7%, afterwards Mobile Banking at 19.8%, Internet Banking at 8.8%, ATM Services at 7.7%.

Interpretation: The overwhelming preference for UPI-based transactions highpoints the exponential growth of the UPI network in Bengaluru; however, it also signals a heightened exposure to UPI-specific frauds such as false payment requests, QR code , and social engineering occurrences targeting UPI credentials.

5.5 Frequency of Digital Banking Usage

Frequency	No. of Respondents	Percentage (%)
Daily	57	62.6%
Weekly	20	22.0%
Occasionally	9	9.9%
Rarely	5	5.5%
Total	91	100%

Analysis: The more respondents (62.6%) use digital banking uses on a daily basis, with 22% utilizing them weekly, demonstrating a very high level of digital banking engagement among the reviewed residents.

Interpretation: The more frequency of digital banking practise among Bengaluru respondents amplifies their collective exposure to potential cyber threats ; frequent users must therefore keep consistently great levels of attentiveness, making cyber security awareness not merely desirable but essential.

5.6 Receipt of Suspicious Calls, Messages, or Emails

Response	No. of Respondents	Percentage (%)
Sometimes	45	49.5%
Rarely	20	22.0%
Frequently	16	17.6%
Never	10	11.0%
Total	91	100%

Analysis: As much as 49.5% of respondents reported receiving suspicious banking-related contacts sometimes, with 17.6% receiving them commonly, indicating that social engineering harms are a common experience for banking customers in Bengaluru.

Interpretation: The fact that almost 67% of respondents have encountered doubtful communications at least sometimes underlines the pervasive nature of phishing and vishing attempts targeting banking clients, reaffirms the critical need for enduring fraud awareness drives.

5.7 Awareness of Phishing Scams, Fake Links, and OTP Frauds

Awareness Level	No. of Respondents	Percentage (%)
Highly Aware	34	37.4%
Aware	42	46.2%
Slightly Aware	12	13.2%
Not Aware	3	3.3%
Total	91	100%

Analysis: A related 83.6% of respondents recognised themselves as either Highly Aware (37.4%) or Aware (46.2%) of phishing scams, fake links, and OTP frauds, while 13.2% were only slightly aware and 3.3% were completely do not know.

Interpretation: The high awareness about OTP frauds is a positive indicator; however, the presence of a segment (16.5%) with limited or no awareness of these prevalent fraud techniques represents a critical vulnerability that cyber criminals dynamically exploit.

5.8 Regularity of Updating Banking Passwords/PINs

Response	No. of Respondents	Percentage (%)
Sometimes	37	40.7%
Rarely	24	26.4%
Always	19	20.9%
Never	11	12.1%
Total	91	100%

Analysis: Only 20.9% of respondents always update their banking passwords and PINs frequently, while 40.7% do so sometimes, 26.4% rarely, and 12.1% not ever update their authorisations — indicating that consistent password hygiene is mostly absent among Bengaluru customers.

Interpretation: The disturbingly high proportion of respondents around 79% who do not steadily update their passwords reveals a major behavioural gap between awareness and actual security training, making them susceptible to credential theft and account takeover frauds.

5.9 Confidence in Identifying Fraudulent Banking Activities

Confidence Level	No. of Respondents	Percentage (%)
Confident	55	60.4%
Very Confident	17	18.7%
Slightly Confident	17	18.7%
Not Confident	2	2.2%
Total	91	100%

Analysis: 79.1% of respondents indicated confident 60.4% ; 18.7% Very Confident in their skill to identify false banking activities online, while 18.7% were only slightly confident and 2.2% were not assured.

Interpretation: Many respondents feel confident in identifying fraud, this self-assessed confidence may not align with actual finding capability, especially given the increasing of present digital fraud techniques such as deepfakes and AI-generated phishing messages.

5.10 Adequacy of Bank-Provided Cyber Security Awareness

Response	No. of Respondents	Percentage (%)
Agree	50	54.9%
Strongly Agree	16	17.6%

Response	No. of Respondents	Percentage (%)
Neutral	18	19.8%
Disagree	7	7.7%
Total	91	100%

Analysis: 72.5% of respondents agreed 54.9% and strongly agreed 17.6% that their banks provide full information about cyber security and digital fraud prevention, while 19.8% neutral and 7.7% disagreed.

Interpretation: The optimistic perception of bank-led awareness creativities is encouraging; yet, the 27.5% of respondents who are disagree indicate that a significant of bank customers feel that current awareness effort by banks are inadequate or unsuccessful.

5.11 Perceived Main Cause of Digital Banking Fraud

Cause	No. of Respondents	Percentage (%)
Lack of Customer Awareness	37	40.7%
Sharing OTP/PIN	26	28.6%
Weak Security Systems	20	22.0%
Poor Cyber Security Practices	8	8.8%
Total	91	100%

Analysis: 40.7% of respondents identified 'Lack of Customer Awareness' as the primary cause of digital banking fraud, followed by 'Sharing OTP/PIN' at 28.6%, 'Weak Security Systems' at 22%, and 'Poor Cyber Security Practices' at 8.8%.

Interpretation: The overwhelming acknowledgment of digital fraud to absence of customer awareness by the respondents themselves reinforces the central premise of this study that educating customer awareness is the most dangerous lever in reducing digital banking fraud in Bengaluru.

5.12 Effective Measures to Reduce Cyber Fraud in Banking

Measure	No. of Respondents	Percentage (%)
Customer Awareness Programs	35	38.5%
Strong Password Protection	25	27.5%
Advanced Banking Security Systems	18	19.8%
Strict Government Regulations	13	14.3%
Total	91	100%

Analysis: 38.5% of respondents advocated for Customer Awareness Programs as the most effective measure to reduce cyber fraud, followed by Strong Password Protection (27.5%), Advanced Banking Security Systems (19.8%), and Strict Government Regulations (14.3%).

Interpretation: The consistent emphasis by respondents on awareness-based measures across both causes and solutions of digital fraud confirms that educational and behavioural interventions must be placed at the forefront of any comprehensive anti-fraud strategy in the banking sector.

Findings

Based on the primary data collected from 91 respondents in Bengaluru, the following key findings have been drained:

1. The most of respondents 84.6% were young adults aged 18–25, with a near-equal gender distribution 51.6% male, 48.4% female, indicating the strong digital banking participation of Bengaluru's youth.
2. While 83.5% of respondents were know about cyber security risks, 16.5% remained completely unaware, representing a vulnerable segment highly usceptible to digital fraud.
3. UPI Transactions were the most frequently used banking service (63.7%), with 62.6% using digital banking daily, intensifying exposure to UPI-specific fraudulent schemes.
4. Approximately 67% of respondents have encountered suspicious calls, messages, or emails related to banking, confirming the prevalence of phishing and social engineering attacks in Bengaluru.

5. A critical behavioural gap was observed — despite high phishing awareness (83.6%), only 20.9% of respondents consistently update their banking passwords, revealing that awareness alone does not ensure safe digital behaviour.

Suggestions

Based on the findings, the following suggestions are given to banks, regulatory bodies, and policymakers:

1. Banks should instrument structured, multi-channel Customer Cyber Security Awareness Programs through SMS alerts, in-app notifications, and branch-level sessions, focusing especially on senior citizens and less income customers who are most helpless to digital fraud.
2. Banks and the RBI should enforce compulsory periodic password reset policies integrated within mobile and internet banking platforms, supported by automated reminders to cultivate consistent password among users.
3. Banks and National payments corporation of India should launch dedicated UPI fraud awareness campaigns addressing QR code scams, fake payment requests, and social engineering threats, given the dominant adoption of UPI transactions among respondents.
4. Banks should invest in AI-powered real-time fraud detection systems providing instant transaction alerts, while simultaneously educating customers on how to respond promptly to apprehensive account activities.
5. The RBI and the Ministry of Finance should enforce stricter data protection regulations tailored to digital banking, mandate quarterly cybersecurity audits, and require public expose of fraud statistics to strengthen institutional accountability.

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Intergenerational Impact of Occupational Stress on Psychological Wellbeing and Future Aspirations of Saltpan Workers Children in Thoothukudi

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Abstract

Salt pan workers have stressful jobs whose effects spill over and damage the mental and emotional health of the children. This study seeks to understand the psychological effects of occupational stress on children of salt pan workers in in Tamil Nadu. Primary data was collected from 90 respondents and the rest of the data was collected from various publications and online sources. Data analysis was done using percentage analysis and independent sample t-test. It was observed that excessive occupational stress that is caused by exposure to high temperatures, seasonal employment, insufficient wages, and physical fatigue negatively impacts the psychological development of children and alters family dynamics. There is no observable impact on the balance between work and family in the case of joint versus nuclear families. Continuous stress caused by work affects the self-esteem and emotional stability of children and decreases their motivation to learn and limits their aspirations for a career. Unquestionably, the stress from work impacts the health and the psychological development of salt pan workers and affects the social and educational future of their children. It is recommended that the working conditions of the salt pan workers are improved, fair wages are implemented, and counselling is provided to break the economic disadvantage that is carried across generations.

Keywords: Occupational Stress, Intergenerational Impact, Psychological Well-being, Future Aspirations, Saltpan Workers, Children of saltpan workers

1. Introduction

In the specific context of Thoothukudi, saltpan workers often belong to marginalized communities with limited access to education and healthcare. Children of saltpan workers frequently grow up in economically impoverished and socially marginalized environments. These children are indirectly affected by their parents' job stress, which might influence their psychological development and future prospects. Children in these communities may encounter barriers such as inadequate schooling facilities, lack of career guidance, and social discrimination. As a result, their aspirations may be shaped more by constraints than by opportunities. Understanding the relationship between parental occupational stress and children's psychological wellbeing and aspirations is crucial for developing effective policies and interventions. By examining this intergenerational impact, researchers can identify the underlying factors that contribute to poor mental health outcomes and limited aspirations among children. This knowledge can help in designing programs aimed at improving working conditions, providing mental health support, and enhancing educational opportunities for children.

2. Statement of the Problem

Occupational stress is not limited to the job; it frequently has an impact on the family setting. Chronically stressed parents may experience emotional tiredness, financial difficulties, a decrease in family engagement, and challenges in supporting their children emotionally and academically. As a result, children may suffer from psychological issues like anxiety, low self-esteem, emotional instability, low academic motivation, and diminished resilience. These factors may also influence their future aspirations, including their educational goals, career choices, and expectations for social and economic mobility. In the absence of suitable solutions, the negative consequences of parental work stress may persist across generations, limiting opportunities for social and economic advancement.

3. Objectives of the Study

- To examine the future educational and career aspiration of the children of saltpan workers.
- To analysing the parental occupational stress influences children's educational motivation, career expectations, and future aspirations.
- To suggest appropriate policy measures for improving improving the psychological well-being and future aspirations of saltpan workers' children.

4. Collection of Data

Primary data was collected by framing a questionnaire. A set of questionnaire was prepared and was given to selected saltpan workers to know their views. The secondary data was collected from magazines, books, journals and web data has also been collected. Daily newspaper was a competent tool in collecting secondary data

5. Sample Size

The present study is based on the primary data, collected from the Tuticorin District. Totally 90 sample workers were collected information through a structured questionnaire method.

6. Frame Work Analysis

The main object was to collect appropriate data, which work as a base for drawing conclusions and getting results. The data collected through questionnaire were analysed through the statistical tools. The following tools were used, they are, T – test Method and Percentage analysis

7. Data Analysis and Interpretation

Table 1: Socio Demographic of the Saltpan Workers

Particulars	No. of. Respondents	Percentage
Gender		
Male	23	26
Female	67	74
Total	90	100
Age		
20 – 30	19	21
31 – 40	30	33
41 – 50	26	29
Above 50	15	17
Total	90	100

Educational Status		
Primary	27	30
Secondary	30	33
Higher Secondary	25	28
Graduate	8	9
Total	90	100
Type of Family		
Joint family	36	40
Nuclear family	54	60
Total	90	100
Average Monthly Income		
Below Rs10,000	22	24
Rs10,001 – Rs15,000	31	34
Rs15,001 – Rs20,000	23	25
Above 20,000	15	17
Total	90	100
Mode of Wage Payment		
Daily	56	62
Weekly	17	19
Monthly	10	11
Seasonal	7	8
Total	90	100

Interpretation

The gender distribution indicates that out of 90 respondents, 67 (74%) are female and 23 (26%) are male. This shows that women constitute the majority of the workforce in the selected saltpans, suggesting that female labour plays a significant role in salt production activities.

With regard to age, 30 respondents (33%) belong to the 31–40 years age group, followed by 26 respondents (29%) in the 41–50 years age group. Nineteen respondents (21%) are between 20 and 30 years, while 15 respondents (17%) are above 50 years of age. This indicates that the majority of the respondents are in their economically productive working age, reflecting the physically demanding nature of saltpan work.

The educational status reveals that 30 respondents (33%) have completed secondary education, 27 respondents (30%) have primary education, 25 respondents (28%) have completed higher secondary education, and only 8 respondents (9%) are graduates. This suggests that most saltpan workers possess only basic levels of education, with very few having attained higher education.

Regarding the type of family, 54 respondents (60%) belong to nuclear families, whereas 36 respondents (40%) belong to joint families. This indicates that nuclear family arrangements are more common among the respondents.

The monthly income distribution shows that 31 respondents (34%) earn between ₹10,001 and ₹15,000 per month, followed by 23 respondents (25%) earning ₹15,001–₹20,000, 22 respondents (24%) earning below ₹10,000, and 15 respondents (17%) earning above ₹20,000. This indicates that the majority of the workers earn relatively modest incomes, reflecting the low-income nature of employment in the saltpan sector.

With respect to the mode of wage payment, 56 respondents (62%) receive wages on a daily basis, 17 respondents (19%) are paid weekly, 10 respondents (11%) receive monthly wages, and 7 respondents (8%) receive seasonal payments. This indicates that daily wage payment is the predominant system, highlighting the casual and labour-intensive nature of employment in the saltpan industry.

Overall, the socio-demographic profile reveals that the majority of the respondents are female, belong to the 31–40 years age group, have secondary-level education, live in nuclear families, earn between ₹10,001 and ₹15,000 per month, and receive wages on a daily basis. These characteristics reflect the socio-economic conditions of saltpan workers and provide an important context for understanding their occupational challenges and psychological well-being.

Table 2: T test Problems at Work which cause Work Life balance

H 0: There is no significant mean difference between joint and nuclear family workers in saltpan on the problems at work which cause work life balance.

Problems caused by Work	Family	Number	Mean	Standard Deviation	T	P value	Null Hypothesis status
Exposed to excessive heat during work.	Nuclear	52	2.23	.854	-.060	.952	Not significant
	joint	8	2.25	.707			
Work causes severe physical fatigue.	Nuclear	52	1.79	.723	-1.632	.108	Not significant
	joint	8	2.25	.886			
Income is insufficient to meet my family's needs.	Nuclear	52	1.98	.852	1.949	.056	Not significant
	joint	8	1.38	.518			
Occupational stress affects my relationship with my family.	Nuclear	52	2.23	.831	.335	.739	Not significant
	joint	8	2.13	.835			
I am stressed about my children's future because of my work conditions.	Nuclear	52	1.94	.802	-.613	.542	Not significant
	joint	8	2.13	.641			
Seasonal employment creates financial insecurity.	Nuclear	52	2.00	.767	.413	.681	Not significant
	joint	8	1.88	.991			

Interpretation

Since, the P value is more than 0.05, the null hypothesis is accepted. Hence there is no significant mean difference between joint and nuclear family workers in saltpan industry on the problems ‘excessive heat during work.’, ‘Work causes severe physical fatigue.’, ‘Income is insufficient’, ‘Occupational stress affects my relationship with my family.’, ‘stressed about my children's future’, ‘Seasonal employment creates financial insecurity.’ which cause work life balance.

8. Conclusion

The study shows that persistent occupational stress experienced by parents affects family life, which in turn affects the psychological well-being of their children. Children of saltpan workers under a lot of stress are more likely to suffer from worry, mental anguish, low self-esteem, and decreased motivation. Their academic success and future professional goals may also be impacted by these psychological difficulties. Overall, the study concludes that occupational stress has an intergenerational impact that influences not only the health and quality of life of saltpan workers but also the psychological development and future aspirations of their children. Therefore, reducing occupational stress and improving the socio-economic conditions of saltpan worker families are essential for breaking the cycle of occupational and economic disadvantage across generations.

9. Suggestion

1. Fair wages, timely wage payments, social security benefits, and employment protection should be strengthened to reduce financial stress among saltpan workers.
2. Educational assistance, scholarships, free learning materials, and career guidance programmes should be provided to the children of saltpan workers to encourage higher education and career development.
3. Future research may examine additional factors such as parental education, family resilience, social support, parenting practices, academic performance, and community resources to gain a deeper understanding of the intergenerational effects of occupational stress.
4. Policymakers should formulate comprehensive welfare policies that focus not only on improving the working conditions of saltpan workers but also on promoting the educational, psychological, and socio-economic development of their children.

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FinTech Innovation: Opportunities and Challenges in India

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Abstract

Financial Technology (FinTech) has transformed the global financial services industry by integrating advanced technologies into banking, payments, lending, insurance, investment management, and wealth management. India has emerged as one of the world's fastest-growing FinTech ecosystems, supported by rapid digitalization, widespread smartphone penetration, affordable internet connectivity, government initiatives such as Digital India, and the development of Digital Public Infrastructure (DPI). Innovations including Aadhaar, the Unified Payments Interface (UPI), Account Aggregator (AA), and the Open Credit Enablement Network (OCEN) have significantly improved financial inclusion, operational efficiency, and customer convenience. The adoption of Artificial Intelligence (AI), blockchain, cloud computing, big data analytics, and application programming interfaces (APIs) has further accelerated innovation across the financial sector. Despite remarkable progress, India's FinTech ecosystem faces several challenges, including cybersecurity threats, data privacy concerns, digital fraud, regulatory uncertainty, digital literacy gaps, and increasing competition. Sustainable FinTech development therefore requires balancing technological innovation with effective governance, customer trust, regulatory compliance, and financial stability. This conceptual review synthesizes recent academic literature and institutional reports published between 2020 and 2025 to examine the opportunities and challenges associated with FinTech innovation in India. The study identifies key technological drivers, emerging business models, regulatory developments, and implementation barriers affecting the sector. The review further proposes a conceptual framework linking technological innovation, Digital Public Infrastructure, regulatory support, customer trust, and financial inclusion to sustainable FinTech development. The findings indicate that while India possesses significant potential to become a global FinTech leader, long-term success depends on strengthening cybersecurity, improving digital literacy, promoting ethical AI, encouraging regulatory

innovation, and fostering collaboration among financial institutions, technology providers, and policymakers. The study provides useful insights for regulators, financial institutions, FinTech startups, researchers, and policymakers seeking to develop resilient and inclusive digital financial ecosystems.

Keywords: *FinTech, Digital Payments, Financial Inclusion, UPI, Artificial Intelligence, Blockchain, Digital Public Infrastructure, Cybersecurity, Digital Lending, India*

1. Introduction

Financial Technology (FinTech) refers to the application of innovative digital technologies to improve the delivery of financial products and services. Technologies such as Artificial Intelligence (AI), blockchain, cloud computing, big data analytics, mobile applications, and application programming interfaces (APIs) have transformed traditional banking by making financial services faster, more accessible, transparent, and customer-centric. Across the world, FinTech has reshaped banking, digital payments, lending, insurance, wealth management, and investment services while improving operational efficiency and customer experience.

India has become one of the world's leading FinTech markets due to supportive government policies, increasing smartphone usage, affordable internet services, and rapid digital transformation. Government initiatives including Digital India, Pradhan Mantri Jan Dhan Yojana (PMJDY), Aadhaar, and the Unified Payments Interface (UPI) have significantly expanded access to formal financial services. Collectively, these initiatives have established India's Digital Public Infrastructure (DPI), enabling secure digital identity verification, instant payments, paperless banking, and seamless financial transactions.

Among these innovations, UPI has revolutionized India's payment ecosystem by enabling real-time, low-cost, and interoperable digital transactions. Millions of individuals, merchants, and businesses now use UPI-based applications for daily financial transactions, making India one of the global leaders in digital payments. The COVID-19 pandemic further accelerated digital payment adoption as consumers increasingly shifted toward contactless transactions and online financial services.

The Indian FinTech ecosystem has expanded rapidly beyond payments into digital lending, InsurTech, WealthTech, RegTech, embedded finance, and digital investment platforms. Artificial Intelligence has improved fraud detection, customer service, credit assessment, and personalized financial planning, while blockchain offers opportunities for secure transactions, smart contracts, and decentralized financial applications.

However, rapid digitalization also presents several challenges. Cybersecurity threats, phishing attacks, identity theft, digital fraud, data privacy concerns, and regulatory complexities continue to affect consumer trust and operational resilience. Digital literacy gaps and unequal access to internet connectivity also limit the benefits of FinTech for certain population groups, particularly in rural areas.

Considering these opportunities and challenges, a comprehensive understanding of India's evolving FinTech landscape is essential for developing sustainable business strategies. This study therefore reviews recent literature to examine the technological, regulatory, and managerial factors shaping FinTech innovation in India.

2. Review of Literature

FinTech innovation has attracted considerable academic and policy attention due to its transformative impact on financial services. Recent studies consistently demonstrate that technological innovation, supportive regulation, and digital infrastructure have accelerated financial inclusion and digital economic development in India.

Gomber, Koch, and Siering (2020) describe FinTech as a disruptive force that improves efficiency, transparency, and customer experience while encouraging collaboration between traditional banks and technology firms. Similarly, Arner, Barberis, and Buckley (2021) emphasize that regulatory innovation is equally important as technological innovation, highlighting the role of Regulatory Sandboxes and RegTech in promoting responsible financial innovation.

The **Reserve Bank of India (2024)** identifies FinTech as a key driver of digital financial inclusion through initiatives such as Digital Lending Guidelines, the Account Aggregator framework, and the Central Bank Digital Currency (CBDC). Likewise, the **World Bank (2022)**

reports that India's integration of Aadhaar, Jan Dhan accounts, and mobile connectivity has substantially reduced financial exclusion by enabling millions of citizens to access formal financial services.

Industry reports further reinforce these findings. **Deloitte (2023)** and **PwC India (2023)** observe that digital payments remain the largest FinTech segment, while embedded finance, AI-driven lending, WealthTech, and Banking-as-a-Service (BaaS) represent emerging growth areas. The reports also highlight increasing collaboration between banks and FinTech startups, enabling faster innovation and improved customer services.

Artificial Intelligence has emerged as a major technological driver of FinTech innovation. **Bhandari and Bansal (2023)** argue that AI improves fraud detection, credit scoring, customer support, and investment advisory services. Similarly, **McKinsey (2023)** predicts that AI-powered personalization and intelligent automation will become critical competitive advantages for financial institutions.

Cybersecurity remains one of the most frequently discussed challenges. **Kumar and Gupta (2024)** identify phishing attacks, ransomware, API vulnerabilities, and digital payment fraud as major threats affecting India's financial ecosystem. They recommend advanced cybersecurity frameworks supported by AI-based monitoring, multi-factor authentication, and continuous threat detection.

The literature also recognizes the strategic importance of Digital Public Infrastructure (DPI). Reports from the **International Monetary Fund (2023)**, **Bank for International Settlements (2023)**, and the **World Economic Forum (2023)** identify India's UPI ecosystem as a global model for interoperable digital payments and financial inclusion. These institutions argue that Digital Public Infrastructure enables innovation by reducing transaction costs, improving interoperability, and expanding access to affordable financial services.

Despite significant progress, several gaps remain in the existing literature. Most studies examine specific FinTech sectors such as digital payments, AI, or blockchain independently rather than providing an integrated understanding of technological innovation, customer trust, regulatory governance, cybersecurity, and sustainable business growth. Limited research also explores the combined influence of Digital Public Infrastructure and emerging technologies on long-term FinTech sustainability.

Therefore, this study seeks to synthesize recent academic and institutional literature to provide a holistic understanding of FinTech innovation in India, focusing on both its opportunities and challenges while developing a conceptual perspective on sustainable digital financial development.

3. Research Gap

The rapid growth of Financial Technology (FinTech) has attracted considerable attention from researchers, policymakers, and industry practitioners. Existing literature extensively discusses individual aspects of FinTech such as digital payments, Artificial Intelligence (AI), blockchain, digital lending, cybersecurity, and financial inclusion. While these studies have significantly contributed to understanding the FinTech ecosystem, several important research gaps remain.

First, most studies focus on specific technologies or individual FinTech segments rather than providing an integrated perspective that combines technological innovation, Digital Public Infrastructure (DPI), regulatory governance, customer trust, and sustainable business strategies. Second, although India has emerged as a global leader in digital payments through initiatives such as the Unified Payments Interface (UPI), Aadhaar, and the Account Aggregator framework, limited research examines how these initiatives collectively contribute to long-term business sustainability and inclusive economic growth.

Third, existing research primarily investigates consumer adoption of FinTech services while comparatively less attention has been given to organizational capabilities, ecosystem collaboration, and strategic partnerships between banks, FinTech firms, technology providers, and regulators. Furthermore, emerging technologies such as Generative AI, embedded finance, decentralized finance (DeFi), and Central Bank Digital Currency (CBDC) remain underexplored within the Indian context.

Finally, many studies discuss either the opportunities or the challenges of FinTech independently. Limited research provides a comprehensive framework that simultaneously examines technological innovation, cybersecurity, regulation, financial inclusion, and customer trust. This study addresses these gaps by developing an integrated conceptual understanding of FinTech innovation and its implications for sustainable business development in India.

4. Research Questions

The study seeks to answer the following research questions:

RQ1: What are the major technological innovations driving FinTech development in India?

RQ2: How has Digital Public Infrastructure (DPI) contributed to financial inclusion and digital transformation?

RQ3: What opportunities does FinTech create for financial institutions, businesses, consumers, and the economy?

RQ4: What are the major challenges affecting sustainable FinTech development in India?

RQ5: How do regulatory frameworks and customer trust influence FinTech adoption and long-term sustainability?

5. Objectives of the Study

The study aims to achieve the following objectives:

1. To examine the current landscape of FinTech innovation in India.
2. To identify the technological drivers influencing digital financial transformation.
3. To analyse the opportunities created by FinTech for financial inclusion and business growth.
4. To examine the challenges related to cybersecurity, regulation, data privacy, and digital literacy.
5. To develop a conceptual framework for sustainable FinTech innovation in India.
6. To provide recommendations for policymakers, regulators, financial institutions, and FinTech companies.

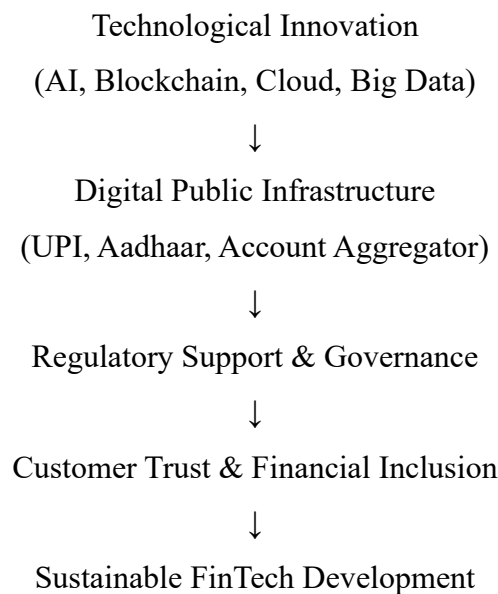
6. Conceptual Framework

The study proposes a conceptual framework that explains the relationship between technological innovation, Digital Public Infrastructure, regulatory governance, customer trust, financial inclusion, and sustainable FinTech development.

The framework suggests that technological innovations such as Artificial Intelligence, blockchain, cloud computing, big data analytics, and APIs drive digital financial services. These innovations are strengthened by India's Digital Public Infrastructure, including Aadhaar, UPI, DigiLocker, Account Aggregator, and OCEN, which provide secure, interoperable, and scalable financial ecosystems.

A supportive regulatory environment, represented by the Reserve Bank of India (RBI), SEBI, and other regulatory bodies, facilitates responsible innovation through Regulatory Sandboxes, digital lending guidelines, and cybersecurity frameworks. Customer trust and financial inclusion act as mediating factors, while cybersecurity, data privacy, digital literacy, and regulatory uncertainty moderate the relationship between innovation and sustainable FinTech development.

Proposed Framework



Moderating Variables

- Cybersecurity
- Data Privacy
- Digital Literacy
- Infrastructure Readiness
- Regulatory Adaptability

7. Research Methodology

This study adopts a systematic conceptual literature review to analyse recent developments in FinTech innovation in India. Since the objective is to synthesize existing knowledge rather than collect primary data, a qualitative research approach has been employed. Secondary data were collected from peer-reviewed journal articles indexed in Scopus, Web of Science, ScienceDirect, SpringerLink, Emerald Insight, Taylor & Francis, IEEE Xplore, and Google Scholar. In addition, reports published by the Reserve Bank of India (RBI), National

Payments Corporation of India (NPCI), World Bank, International Monetary Fund (IMF), Bank for International Settlements (BIS), OECD, Asian Development Bank (ADB), Deloitte, PwC, EY, KPMG, and Accenture were reviewed.

Only studies published between 2020 and 2025 were considered to ensure the inclusion of recent technological and regulatory developments. Keywords such as *FinTech Innovation*, *Digital Payments*, *UPI*, *Artificial Intelligence*, *Blockchain*, *Financial Inclusion*, *Cybersecurity*, *Digital Lending*, and *India* were used to identify relevant literature.

The collected studies were analysed using thematic analysis, which involved coding, categorizing, and interpreting recurring themes. This approach enabled the identification of key opportunities, challenges, and strategic implications associated with FinTech innovation in India.

8. Thematic Analysis and Discussion

The review of recent literature identified six major themes explaining the evolution of India's FinTech ecosystem.

Theme 1: Digital Payments and Financial Inclusion

Digital payments have become the foundation of India's FinTech ecosystem. The success of the Unified Payments Interface (UPI), Aadhaar, and Jan Dhan Yojana has significantly expanded financial inclusion by enabling millions of previously unbanked individuals to access formal financial services. Digital payments have reduced transaction costs, improved transparency, and supported the growth of small businesses and MSMEs. However, challenges such as digital fraud, infrastructure disparities, and financial literacy gaps continue to affect adoption.

Theme 2: Artificial Intelligence and Automation

Artificial Intelligence has transformed financial services through automated customer support, fraud detection, personalized financial advice, predictive credit scoring, and risk management. AI enables financial institutions to improve operational efficiency while enhancing customer experience. Nevertheless, concerns regarding algorithmic bias, transparency, explainability, and data privacy require careful governance to ensure ethical AI adoption.

Theme 3: Blockchain and Digital Public Infrastructure

Blockchain technology enhances transaction security, transparency, and operational efficiency through decentralized ledgers and smart contracts. More importantly, India's Digital Public Infrastructure—including UPI, Aadhaar, DigiLocker, and the Account Aggregator framework—has created a globally recognized model for secure and interoperable digital financial services. These technologies strengthen customer trust and support innovation across banking, lending, insurance, and wealth management.

Theme 4: Cybersecurity and Data Privacy

The increasing use of digital financial services has heightened cybersecurity risks, including phishing, identity theft, ransomware, API attacks, and payment fraud. The literature emphasizes the need for AI-enabled cybersecurity systems, multi-factor authentication, robust encryption, and customer awareness programmes. Strong data governance and privacy protection are essential for maintaining customer trust and regulatory compliance.

Theme 5: Regulatory Innovation

India has adopted a progressive regulatory approach through Regulatory Sandboxes, digital lending guidelines, Account Aggregator policies, and payment regulations. Regulatory innovation encourages responsible experimentation while protecting consumers and maintaining financial stability. Continued collaboration between regulators and industry participants remains essential as new technologies such as Generative AI and CBDCs evolve.

Theme 6: Sustainable FinTech Business Models

The literature suggests that future FinTech success will depend on sustainable business models emphasizing collaboration, operational resilience, customer-centric innovation, ethical AI, and environmental, social, and governance (ESG) considerations. Strategic partnerships among banks, FinTech firms, technology providers, and regulators will be critical for achieving long-term competitiveness and inclusive economic growth.

Overall, the thematic analysis demonstrates that sustainable FinTech development requires balancing technological innovation with robust governance, cybersecurity, customer trust, and financial inclusion. India possesses significant opportunities to become a global leader in digital finance, provided these challenges are addressed through coordinated policy and industry efforts.

9. Discussion

The findings of this conceptual review indicate that FinTech has become a key driver of digital transformation and financial inclusion in India. The integration of Digital Public Infrastructure (DPI), including Aadhaar, the Unified Payments Interface (UPI), DigiLocker, and the Account Aggregator framework, has enabled the delivery of secure, interoperable, and customer-centric financial services. Government initiatives such as Digital India and the Pradhan Mantri Jan Dhan Yojana have further strengthened financial accessibility by connecting millions of citizens to formal banking services.

Technological innovations such as Artificial Intelligence (AI), blockchain, cloud computing, big data analytics, and application programming interfaces (APIs) have significantly improved the efficiency and accessibility of financial services. AI has enhanced fraud detection, customer support, personalized financial planning, and credit assessment, while blockchain has increased transparency and security in financial transactions. These technologies have encouraged collaboration between traditional banks and FinTech startups, resulting in innovative products and improved customer experiences.

Despite these achievements, the review identifies several challenges that may affect the long-term sustainability of the Indian FinTech ecosystem. Cybersecurity threats, digital fraud, data privacy concerns, algorithmic bias, and regulatory uncertainty remain significant risks. Moreover, disparities in digital literacy and internet accessibility continue to limit financial inclusion in rural and economically disadvantaged regions. Addressing these issues requires coordinated efforts among regulators, financial institutions, technology providers, and educational institutions.

The review also highlights that technological innovation alone cannot ensure sustainable FinTech growth. Customer trust, effective governance, ethical AI, strong cybersecurity practices, and supportive regulatory policies are equally important. Sustainable FinTech development therefore depends on balancing innovation with consumer protection, operational resilience, and financial stability.

10. Managerial Implications

The findings provide several practical implications for policymakers, regulators, financial institutions, FinTech companies, and educational institutions.

For Policymakers

Government agencies should continue investing in Digital Public Infrastructure while expanding digital literacy programmes and internet connectivity in rural areas. Policies encouraging responsible innovation, startup development, and financial inclusion should remain priorities. Consumer awareness campaigns focusing on digital payment security and cyber hygiene are also essential.

For Regulatory Authorities

Regulators such as the Reserve Bank of India (RBI), SEBI, and IRDAI should continue adopting flexible regulatory approaches through Regulatory Sandboxes and technology-neutral regulations. Strengthening cybersecurity standards, data governance, consumer protection mechanisms, and cross-border regulatory cooperation will support sustainable FinTech growth.

For Banks and Financial Institutions

Banks should strengthen partnerships with FinTech firms to accelerate digital transformation. Investments in AI, cloud computing, blockchain, predictive analytics, and cybersecurity will improve operational efficiency and customer experience. Institutions should also prioritize employee training and modernization of legacy systems.

For FinTech Startups

FinTech companies should focus on sustainable business models rather than rapid expansion alone. Responsible AI, privacy-by-design, robust cybersecurity, and regulatory compliance should be integrated into business strategies. Diversified revenue models and ecosystem partnerships can improve long-term profitability.

For Educational Institutions

Universities should introduce interdisciplinary programmes covering FinTech, Artificial Intelligence, blockchain, cybersecurity, data analytics, and digital finance. Industry collaborations, internships, and certification programmes will help develop a skilled workforce capable of supporting India's expanding digital financial ecosystem.

11. Future Research Directions

The review identifies several areas for future research.

First, empirical studies should examine the impact of Generative AI on financial decision-making, customer service, fraud detection, and investment advisory.

Second, longitudinal research is required to evaluate the effectiveness of India's Central Bank Digital Currency (CBDC) in improving payment systems and financial inclusion.

Third, future studies should explore the growth of embedded finance, Open Finance, and Banking-as-a-Service (BaaS) within India's digital economy. Comparative studies between India and other emerging economies such as Singapore, Brazil, Indonesia, and Kenya would provide valuable insights into alternative regulatory models and innovation ecosystems.

Research is also needed on ethical AI, algorithmic fairness, explainable AI, and customer trust in automated financial services. Finally, scholars should investigate the contribution of Green FinTech, sustainable finance, and ESG-oriented financial technologies in promoting environmentally responsible economic development.

12. Conclusion

FinTech has fundamentally transformed India's financial services sector by improving accessibility, operational efficiency, transparency, and financial inclusion. Supported by Digital Public Infrastructure, government initiatives, and rapid technological innovation, India has established one of the world's most dynamic FinTech ecosystems.

The review demonstrates that technologies such as Artificial Intelligence, blockchain, cloud computing, and digital payments have expanded financial access while encouraging innovation across banking, lending, insurance, and investment services. At the same time, cybersecurity risks, data privacy concerns, regulatory complexity, and digital literacy gaps remain significant challenges requiring continuous attention.

The proposed conceptual framework suggests that technological innovation, Digital Public Infrastructure, and supportive regulation positively influence customer trust and financial inclusion, ultimately leading to sustainable FinTech development. However, these relationships are moderated by cybersecurity, digital literacy, infrastructure readiness, and regulatory adaptability.

For sustainable long-term growth, India must continue strengthening cybersecurity frameworks, ethical AI governance, consumer protection mechanisms, and collaborative partnerships among regulators, financial institutions, technology firms, and academic institutions. With appropriate governance and responsible innovation, India has the potential to become a global leader in digital financial services and a model for inclusive digital economic development.

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A Study on Awareness and Approach of The Investors with Reference to Forex Trading

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Abstract

Though Forex market is the biggest financial instrument traded across the world with more than 6.5 trillion people trade on an average on daily basis. The most traded currency pairs in the world are as the Majors which are Euro (EUR), US Dollar (USD), Japanese Yen (JPY), Pound Sterling (GBP), Australian Dollar (AUD), Canadian Dollar (CAD), and the Swiss Franc (CHF). many traders fail to carry out a successful transaction as they will not construct a systematic and scheduled trading plan and execution maintaining the trading discipline throughout. Most of the traders will not go through risk management rules thoroughly but expects maximum ROI on their investments. conducting a scenario analysis and observing the moves of the current market to reduce the risk and discovering an appropriate trading strategy for sustainability are the most crucial aspects every trader has to adopt and follow for a fruitful return on the money invested. Hence the present study is undertaken to observe, analyse and interpret the psychology of the traders who are indulged in currency market by using the statistical tools. Recommendations and few suggestions also given to eliminate the risk factor. The data required for the study has been collected from primary as well as secondary sources. primary data has been collected through convenience sampling method from the selected traders of currency market through issue of questionnaires. Simple statistical tools such as graphic representation and percentage analysis have been used to arrive at the conclusion.

Keywords: *Forex market, currency pairs, majors, risk management, scenario analysis*

Introduction

What is Forex trading?

Forex or foreign exchange market refers to the global currency trading market. It is the largest and the most liquid financial market across the globe. In Foreign exchange trading, trading one country's money for that of another country's done. The kind of money specifically traded takes the form of bank deposits or bank transfers of deposits denominated in foreign currency. The foreign exchange market typically refers to large commercial banks in financial centers, such as New York or London, that trade foreign-currency-denominated deposits with each other. The foreign exchange market runs twenty four hours a day and it is the largest financial market in the world.

Financial Instruments Traded

Financial instruments for trading currencies are swaps, spot transactions, forwards and options. Currencies are traded in an interbank exchange system by market making currency traders.

The Market Participants

The participants in the foreign exchange market are central banks, commercial banks, institutional investors, traders, hedge funds, commercial companies and retail investors. there is no central marketplace for the exchange of currency in the forex market. It is an OTC market. The currency market is open 24 hours a day, five days a week, with all major currencies traded in all major financial centers.

History of Currency Trading

The current currency rate mechanism has evolved over thousands of years of the world community trying with various mechanism of facilitating the trade of goods and services. Initially, the trading of goods and services was by barter system where in goods were exchanged for each other. Such system had its difficulties primarily because of non divisibility of certain goods, cost in transporting such goods for trading and difficulty in valuing of services.

For example, how does a dairy farmer exchange his cattle for few liters of edible oil or one kilogram of salt? The farmer has no way to divide the cattle! Similarly, suppose wheat is grown in one part of a country and sugar is grown in another part of the country, the farmer has to travel long distances every time he has to exchange wheat for sugar. Therefore the need to have a common medium of exchange resulted in the innovation of money.

People tried various commodities as the medium of exchange ranging from food items to metals. Gradually metals became more prominent medium of exchange because of their ease of transportation, divisibility, certainty of quality and universal acceptance. People started using metal coins as medium of exchange. Amongst metals, gold and silver coins were most prominent and finally gold coins became the standard means of exchange.

The process of evolution of medium of exchange further progressed into development of paper currency. People would deposit gold/ silver coins with bank and get a paper promising that value of that paper at any point of time would be equal to certain number of gold coins. This system of book entry of coins against paper was the start of paper currency. With time, countries started trading across borders as they realized that everything cannot be produced in each country or cost of production of certain goods is cheaper in certain countries than others. The growth in international trade resulted in evolution of foreign exchange (FX) i.e., value of one currency of one country versus value of currency of other country. Each country has its own “brand” alongside its flag. When money is branded it is called “currency”. Whenever there is a cross border trade, there is need to exchange one brand of money for another, and this exchange of two currencies is called “foreign exchange” or simply “forex” (FX).

The smooth functioning of international trade required a universally accepted foreign currency to settle the internal trade and a way to balance the trade imbalances amongst countries. This led to the question of determining relative value of two currencies?

Different systems were tried in past to arrive at relative value of two currencies. The documented history suggests that sometime in 1870 countries agreed to value their currencies against value of currency of other country using gold as the benchmark for valuation.

As per this process, central banks issue paper currency and hold equivalent amount of gold in their reserve. The value of each currency against another currency was derived from

gold exchange rate. For example, if one unit of gold is valued at Indian Rupees (INR) 10,000 and US dollar (USD) 500 then the exchange rate of INR versus USD would be 1 USD = INR 20.

This mechanism of valuing currency was called as gold standard. With further growth in international trade, changing political situations (world wars, civil wars, etc) and situations of deficit/ surplus on trade account forced countries to shift from gold standard to floating exchange rates

In the floating exchange regime, central bank's intervention was a popular tool to manage the value of currency to maintain the trade competitiveness of the country. Central bank would either buy or sell the local currency depending on the desired direction and value of local currency. Later-on, countries adopted a system called Bretton Woods System. This system was a blend of gold standard system and floating rate system.

As part of the system, all currencies were pegged to USD at a fixed rate and USD value was pegged to gold. The US guaranteed to other central banks that they can convert their currency into USD at any time and USD value will be pegged to value of gold. Countries also agreed to maintain the exchange rate in the range of plus or minus 1% of the fixed parity with US dollar.

With adoption of this system, USD became the dominant currency of the world. Finally Bretton Woods system was suspended and countries adopted system of free floating or managed float method of valuing the currency. Developed countries gradually moved to a market determined exchange rate and developing countries adopted either a system of pegged currency or a system of managed rate.

Major Currency Pairs

Base currency and quote currency together make up a currency pair. The term is used to price coins against each other. Conventionally, currency pairs are reflected in abbreviated form, separated by a slash. EUR/USD refers to a currency pair in which the euro is the base currency, and the U.S dollar is the quote currency.

The number of currency units a person wishes to buy or sell is many. One lot comprises 100,000 units of currency. Currency pairs are traded in lots which can also be mini, micro or nano in size. Mini lot equals 10,000 units while micro and nano equal 1000 and 100 units.

The most traded currency pairs in the world are called the Majors. The list includes following currencies:

- Euro (EUR),
- US Dollar (USD),
- Japanese Yen (JPY),
- Pound Sterling (GBP),
- Australian Dollar (AUD),
- Canadian Dollar (CAD),
- Swiss Franc (CHF).

US Dollar (USD)

The US Dollar is by far the most widely traded currency. In part, the widespread use of the US Dollar reflects its substantial international role as “investment” currency in many capital markets, “reserve” currency held by many central banks, “transaction” currency in many international commodity markets, “invoice” currency in many contracts, and “intervention” currency employed by monetary authorities in market operations to influence their own exchange rates. Recent price 1 US Dollar = Rs 77.67

Euro (EUR)

Like the US Dollar, the Euro has a strong international presence and over the years has emerged as a premier currency, second only to the US Dollar. Recent price 1 Euro = Rs 85.62

Japanese Yen (JPY)

The Japanese Yen is the third most traded currency in the world. It has a much smaller international presence than the US Dollar or the Euro. The Yen is very liquid around the world, practically around the clock. Recent Price 1 Yen = Rs 0.6678

British Pound (GBP)

Until the end of World War II, the Pound was the currency of reference. The nickname Cable is derived from the telegrams used to update the GBPUSD rates across the Atlantic. The

currency is heavily traded against the Euro and the US Dollar, but it has a spotty presence against other currencies. Recent Price 1 Pound = Rs 100.39

Swiss Franc (CHF)

The Swiss Franc is the currency of Switzerland and is represented with the symbol CHF. It is one of the most stable currencies in the world and is used as the reserve currency in many of the international transactions. Switzerland has a close economic relationship with the Euro zone and many other countries across the globe. From a foreign exchange point of view, the Swiss Franc closely resembles the patterns of the Euro, but lacks its liquidity. Recent Price 1 Swiss Franc = Rs 82.189

Australian Dollar (AUD)

The **Australian Dollar** is known as a commodity currency due to its substantial raw material exports. As a result, the AUD is affected by China and other Asian import markets. Recent Price for 1 Australian Dollar = Rs 54.299

Canadian Dollar (CAD)

Canadian Dollar is the official currency of **Canada** which is also abbreviated as CAD in the international currency exchange markets. The Canadian Dollar is the seventh-most traded currency on the Forex market, as many institutions and individuals trade the CAD. 1 Canadian Dollar = Rs 59.544

Psychology of Investors

Behavioral finance attempts to understand and explain how human emotions influence financial and investment decision-making processes. According to standard economic theory individual traders of FOREX market behave in a rational manner and that all existing information is embedded in the investment process. Individuals rely completely on rational calculations to make rational choices that result in outcomes aligned with their own best interests, Rational actors thus try to actively maximize their advantage in any situation and consistently try to minimize their losses in a self-interested manner. average investors consistently fail to achieve returns that beat or even match the broader market indices.

Theories on Behavioral Finance

Fear of Regret or simply regret theory, deals with the emotional reaction people experience after realizing they've made an error in judgment. Faced with the prospect of

selling a stock, investors become emotionally affected by the price at which they purchased the stock. So, they avoid selling it as a way to avoid the regret of having made a bad investment, as well as the embarrassment of reporting a loss.

Mental Accounting Behaviors: Humans have a tendency to place particular events into mental compartments, and the difference between these compartments sometimes impacts our behavior more than the events themselves. Usually the traders hesitate to sell an investment that once had monstrous gains and now has a modest gain. They create mental compartments for the gains they once had, causing them to wait for the return of that profitable period.

Prospect Theory and Loss-Aversion: people express a different degree of emotion towards gains than towards losses. Individuals are more stressed by prospective losses than they are happy from equal gains. This theory also explains why investors hold onto losing stocks, people often take more risks to avoid losses than to realize gains. So, despite of their rational desire to get a return for the risks they take, they tend to value something they own higher than the price they would normally be prepared to pay for it.

Anchoring Behaviors: In the absence of better or new information, investors often assume that the market price is the correct price. People tend to place too much credence in recent market views, opinions and events, and mistakenly extrapolate recent trends that differ from historical, long-term averages and probabilities. In bull markets, investment decisions are often influenced by price anchors , which are prices deemed significant because of their closeness to recent prices. This anchoring heuristic makes the more distant returns of the past irrelevant in investors' decisions.

Over- and Under-Reacting: Investors get optimistic when the market goes up, assuming it will continue to do so. Conversely, investors become extremely pessimistic during downturns. A consequence of anchoring, or placing too much importance on recent events while ignoring historical data, is an over- or under-reaction to market events, which results in prices falling too much on bad news and rising too much on good news.

Investor Overconfidence: People generally rate themselves as being above average in their abilities. They also overestimate the precision and veracity of their knowledge -- as well as the perceived superiority of their own knowledge relative to others. Many investors believe they can consistently time and market, but in reality, there's an overwhelming amount of evidence that proves otherwise. Overconfidence results in excess trades, with trading costs denting profits.

Social Factors: While much of behavioral economics to date has been driven by cognitive psychology, recent research from economic sociology indicates that there are also supra-individual forces at work that drive investor behavior. A recent study, for instance, found that individuals become far more conservative when making investment decisions on behalf of close others - with people taking around one-third less risk in a portfolio intended for a child than one allocated for one's own behalf. Moreover, investors became even more conservative with investments made in accounts that had culturally-salient labels such as "retirement" or "college savings."

Literature Review

- According to Borio et al. [2007], the foreign exchange transaction volume has more than doubled between April 2004 and April 2012. This increase of trading activity is attributed mainly to the growing importance of an exchange as an asset class.
- Pojarliev and Levich [2008] concluded that the diversified equity inherent to these trading-styles should replace the riskless interest rate as the benchmark for professional foreign exchange managers since simple replication of these rates return factors should not entitle to an extraordinary remuneration.
- Rime & Schrimpf, (2013) In general, the transaction volume of individual investors (retail investors) is very low compared with institutional parties, but interestingly, their participation in the FOREX markets has been substantially increasing in last decades.
- Brendan Callan, the president of FOREX Capital Markets in Europe, rationalize this picture by claiming that accessibility of currency news in the mainstream media has led the individual investors to become more comfortable with FOREX trading
- Financial Times,(2011). , a recent research on the French securities indicates that the FOREX market is much more complex and the risky for small investors than equity markets and 89% of all active retail clients lose their money.

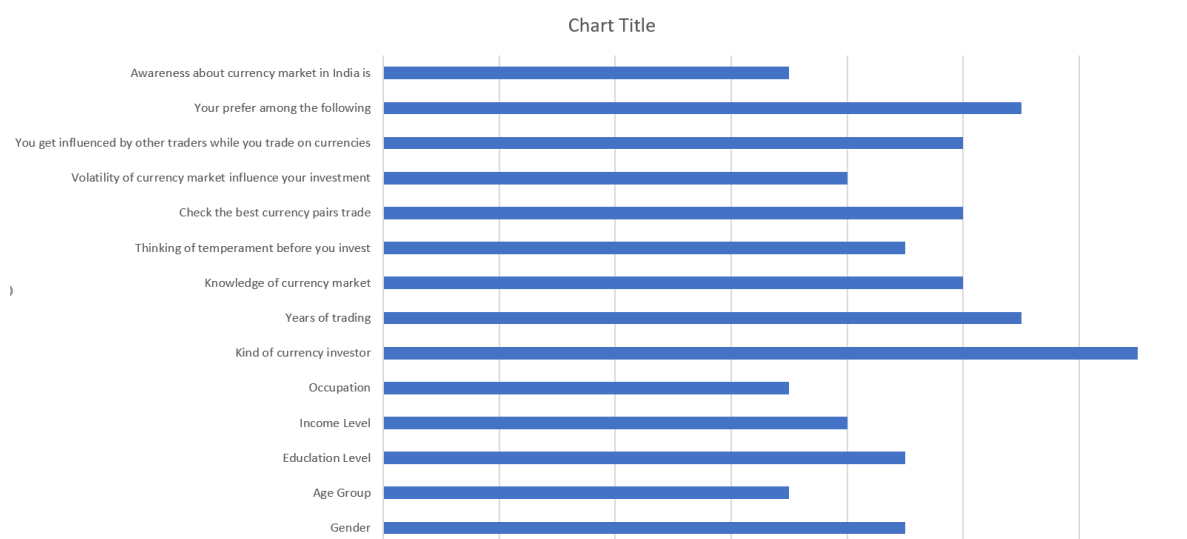
Objectives of the Study

- To understand the components of FOREX trading.
- To identify the popular currency pairs in Forex market.
- To know the psychology (perception and attitude) of the market participants with reference to Forex trading

Research Methodology

The present study is undertaken to observe, analyse and interpret the psychology of the traders who are indulged in currency market by using the statistical tools .Recommendations and few suggestions also given to eliminate the risk factor. The data required for the study has been collected from primary as well as secondary sources . primary data has been collected through convenience sampling method from the selected 60 traders of currency market through issue of questionnaires. Simple statistical tools such as graphic representation and percentage analysis have been used to arrive at the conclusion.

Findings Represented Graphically



Analysis & Interpretation

- ❖ More men are interested in trading in currency market.
- ❖ Maximum traders belong to the Age Group between 25-45 years.
- ❖ Most of the traders have done their graduation
- ❖ Annual Income Level of the traders are ranging from 2-8 lakhs PA.
- ❖ Most of the currency investor invest from their personal income.

- ❖ Many traders are trading in currency market from 3-5 Years.
- ❖ Maximum traders have awareness about derivatives market.
- ❖ Maximum traders have knowledge on derivative market through digital media.
- ❖ Most of the traders agree that digital trading is comfort than physical trading
- ❖ Maximum traders agree that their number of times trading is increased in derivative market by impact of more facilities of digital mode of trading.
- ❖ Most of the traders facing some problems when they trading through digital mode, those are hacking, miss leading, fraud, confusion of more similar opportunities.
- ❖ Digital mode of information is providing plenty of opportunities, this making the confusion in choosing best among them.
- ❖ Maximum traders stated that they need still more knowledge of digital mode of trading.
- ❖ Traders are facing one more problem through digital mode of trading, they facing insecurity

Suggestions

- ❖ Every trader has to take the time to study currency pairs and what affects them before taking risk of investment.
- ❖ Creating a trading plan is a critical component of successful trading which includes profit goals, risk tolerance level, methodology and evaluation criteria.
- ❖ Investors has to find potential trading opportunities in moving markets before start trading.
- ❖ Before trading any investor has to check whether they are willing to risk on each trade, setting their leverage ratio in accordance with their needs, and never risking more than what they can afford to lose.
- ❖ Every trader must Educate themselves and create a trading plan and sticking to that plan through patience and discipline is essential for successful trading.
- ❖ As per the financial situation changes, traders should make modifications in their plan accordingly.

Conclusion

The FX market in today's age, it is powered by telecommunications technology and remains active 24 hours a day. It facilitates over-the-counter transactions in individual currencies between two participants where each individual currency is a market in itself, like the USD market or the GBP market. The foreign exchange market also sees a high volume of

inter-bank transactions, which often define the currency values. Forex markets originated due to the requirements of traders to settle international trades. FX markets remain the oldest financial markets and have a large say in global financial liquidity and as a trader monitoring the market movement foreign exchange market is not just a financial mechanism — it is the circulatory system of global trade and commerce. From its earliest roots in merchant settlements to today's round-the-clock digital ecosystem, the FX market has continuously evolved while holding on to its core purpose: enabling the world to do business across borders. What makes forex genuinely fascinating is its sheer scale and the human drama behind every transaction. Governments, central banks, multinational corporations, and individual traders all share the same arena, each with their own motivations, strategies, and risk appetites. No other market on earth brings together such a diverse cast of participants under one roof — or rather, under one invisible, borderless network.

For traders, the lesson is both simple and humbling. The market rewards those who respect it. Staying informed, reading the signals that interbank activity sends, and treating risk management not as an afterthought but as the foundation of every trade — these habits separate those who last in forex from those who don't. Losses are not a sign of failure; they are part of the education. But avoidable losses — the ones that come from inattention or overconfidence — those are the ones worth fighting hardest against.

The forex market will keep moving long after any individual trade is closed. It does not pause, it does not forgive carelessness, and it does not reward guesswork. But for those willing to learn its rhythms and engage with it thoughtfully, it remains one of the most dynamic and genuinely rewarding markets in the world of finance regularly to avoid or minimize any forex losses is crucial for the success of currency trading.

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Advancing A Sustainable Future Through the PM Vishwakarma Yojana for Artisan Empowerment

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Abstract

Empowering rural artisans is not only about preserving traditional crafts but also about uplifting the socio-economic status of countless families in rural India. It involves bridging the gap between tradition and modernity ensuring that these talented individuals can thrive in a rapidly changing world. Undoubtedly, artisans and craftspeople, through their creativity and skills, have been contributing to the socio-economic milieu. The PM Vishwakarma scheme signifies a promising era where the rich tapestry of India's cultural heritage is not only celebrated but uplifted and propelled into a prosperous future, symbolising a harmonious blend of tradition and modernity. On 17th September 2023, the Hon'ble Prime Minister introduced PM Vishwakarma. The scheme seeks to upskill Vishwakarmas with the knowledge of contemporary technologies and techniques, coupled with credit support to grow their businesses. This study examines the scheme's benefits, process flow, implementation strategies, and key accomplishments of PMVY.

Keywords: *Vishwakarma, Empowerment, Skill Development, Entrepreneurship, MSME*

Introduction

Many craftsmen and craftspeople in the Indian economy work with their hands and tools, are typically self-employed, and are typically seen as belonging to the unorganized or informal sector of the economy. The term "Vishwakarmas" refers to these traditional craftspeople. They work as carpenters, sculptors, potters, blacksmiths, and other craftspeople. In this regard, the PM Vishwakarma program seems as a revolutionary endeavor that aims to improve the calibre and accessibility of goods and services offered by craftspeople and artisans. The program aims to improve these competent people's socioeconomic standing and standard of living by integrating them into both domestic and international value chains. In

addition to financial assistance, the program's components will include social security, digital payments, and brand promotion, access to advanced skill training, understanding of contemporary digital techniques and effective green technology, and connections to local and international markets. Scheduled Castes, Scheduled Tribes, OBCs, women, and members of the weaker groups will all immensely gain from this.

About PM Vishwakarma Scheme

PM Vishwakarma is a Central Sector Scheme, to provide comprehensive support to traditional artisans and craftspeople engaged in manual and tool-based work. The program intends to support about 3 million craftsmen nationally with an initial financial commitment of INR 13,000 crore spread over five years. As the nodal ministry, the Ministry of Micro, Small, and Medium Enterprises (MoMSME) collaborates with the Department of Financial Services (DFS) and the Ministry of Skill Development and Entrepreneurship (MSDE). By supporting artisans in rural and underserved regions, PM Vishwakarma also seeks to preserve India's unique artisanal heritage while enhancing the livelihoods and social mobility of these communities.

Eligibility

- The applicant must be an artisan or craftsperson engaged with hands and tools in one of the 18 family-based traditional trades in the unorganized sector on a self-employment basis.
- He/she must be above 18 years at the time of registration and must be actively working in the trade at registration.
- He/she should not have availed loans under Prime Minister's Employment Generation Programme (PMEGP), MUDRA, PM SVANidhi in the past 5 years, except those who have fully repaid.
- Only one member per family (husband, wife, and unmarried children) can benefit.

Exception

- Government employees and their family members are not eligible.

Eligible Trades

- 18 eligible trades include Carpenter, Boat Maker, Armourer, Blacksmith, Hammer and Tool Kit Maker, Locksmith, Goldsmith, Potter, Sculptor, Stone

breaker, Cobbler/ Shoesmith/Footwear artisan, Mason, Basket/Mat/Broom Maker/Coir Weaver, Doll & Toy Maker, Barber, Garland maker, Washerman, Tailor and Fishing Net Maker.

- The list can be updated and modified by the National Steering Committee with the approval of the Ministry for MSME.

Objectives of PM Vishwakarma

- ✓ To enable the recognition of artisans and craftspeople as Vishwakarma, making them eligible to avail all the benefits under the Scheme.
- ✓ To provide skill upgradation to hone their skills and make relevant and suitable training opportunities available to them.
- ✓ To provide support for better and modern tools to enhance their capability, productivity, and quality of products and services.
- ✓ To provide the beneficiaries easy accesses to collateral free credit and reduce the cost of credit by providing interest subvention.
- ✓ To provide incentives for digital transactions to encourage digital empowerment of Vishwakarmas.
- ✓ To provide a platform for brand promotion and market linkages to help them access new opportunities for growth.

Benefits of the scheme

The Scheme provides of the following benefits to the artisans and crafts persons:

- **Recognition:** Recognition of artisans and craftspeople through PM Vishwakarma certificate and ID card.
- **Skill Upgradation:** Basic Training of 5-7 days and Advanced Training of 15 days or more, with a stipend of Rs. 500 per day;
- **Toolkit Incentive:** A toolkit incentive of upto Rs. 15,000 in the form of e-vouchers at the beginning of Basic Skill Training.
- **Credit Support:** Collateral free 'Enterprise Development Loans' of upto Rs.3 lakh in two tranches of Rs. 1 lakh and Rs. 2 lakh with repayment tenures of 18 months and 30 months, respectively, at a concessional rate of interest fixed at 5%, with Government of India subvention to the extent of 8%. Beneficiaries who have completed Basic Training will be eligible to avail the first tranche of credit support of

upto Rs. 1 lakh. The second loan tranche will be available to beneficiaries who have availed the 1st tranche and maintained a standard loan account and have adopted digital transactions in their business or have undergone Advanced Training.

- **Incentive for Digital Transaction:** An amount of Re. 1 per digital transaction, upto maximum 100 transactions monthly will be credited to the beneficiary's account for each digital pay-out or receipt.
- **Marketing Support:** Marketing support will be provided to the artisans and craftspeople in the form of quality certification, branding, onboarding on e-commerce platforms such as GeM, advertising, publicity and other marketing activities to improve linkage to value chain.
- The beneficiaries will be registered on Udyam Assist Platform as enterprises.

Objectives of the Study

1. To know the financial outlay of the PM Vishwakarma Yojana Scheme.
2. To study the process and implementation of the scheme.
3. To analyze the key achievements and impact of the PM VY scheme.

Research Methodology

The study is based on secondary data collected from official sources such as the PM Vishwakarma Scheme portal, reports of the Ministry of Micro, Small and Medium Enterprises (MSME), government publications, policy documents, and reputable newspapers. The data pertain to the latest available period to reflect the current status of the scheme

Financial Outlay

PM Vishwakarma Yojana: Year-wise fund allocation and the target beneficiaries proposed is given below:

Table 1: Fund Allocation

Financial Year	Budget Allocated (Rs. in crore)
2023-24	1,860
2024-25	4,824
2025-26	3,009
2026-27	1,619

2027-28	1,224
2028-29	342
2029-30	103
2030-31	19
Total	13,000

Source: pmvishwakarma.gov.in

Table 2: Target beneficiaries

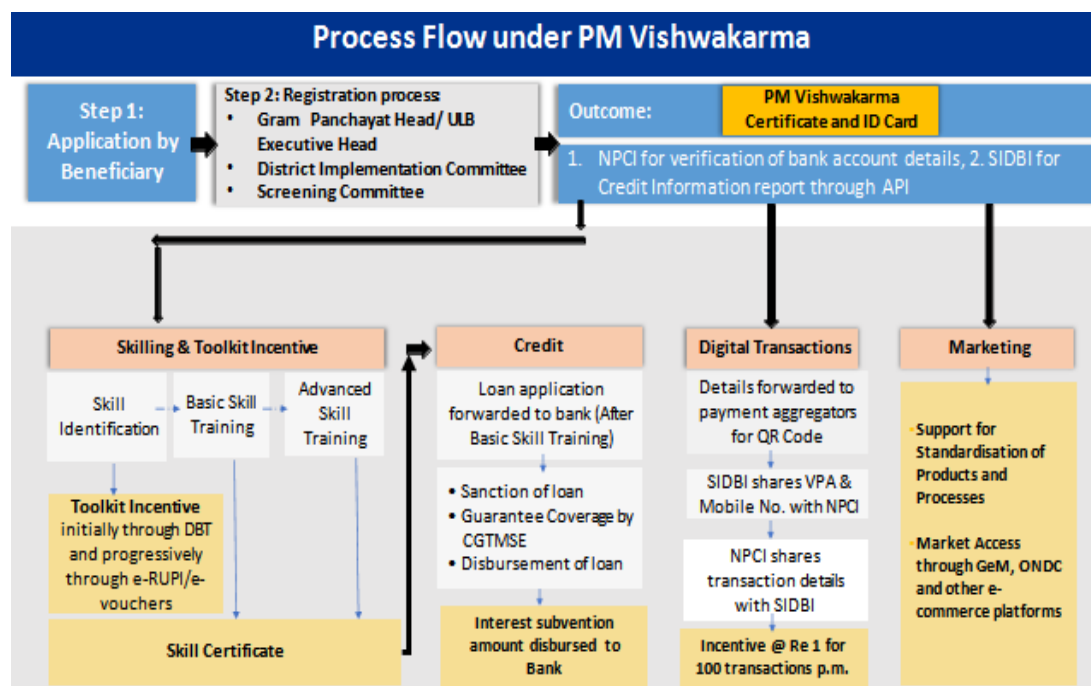
Financial Year	Number of targeted beneficiaries proposed
2023-24	6,00,000
2024-25	18,00,000
2025-26	5,00,000
2026-27	50,000
2027-28	50,000
Total	30,00,000

The total budget allocation of R.13,000 crore is distributed over eight financial years, with the highest allocation in 2024–25 (Rs.4,824 crore), followed by 2025–26 (Rs.3,009 crore). The budget is concentrated in the initial years to support the rapid implementation of the scheme, while allocations gradually decline from 2028–29 onwards, indicating a phased completion of activities and reduced funding requirements in the later years. This pattern reflects a front-loaded investment strategy aimed at establishing the programme during its early stages.

The scheme initially targeted 30 lakh beneficiaries over a five-year period (FY 2023–24 to FY 2027–28). However, it successfully achieved the entire target of 30 lakh registrations within just two years of implementation. This reflects the scheme's strong outreach, effective implementation, and high level of participation among eligible beneficiaries, demonstrating performance well ahead of the planned timeline.

Process Flow under PM Vishwakarma Scheme

Figure 1. Process Flow under PM Vishwakarma



Source: Ministry of MSMEs, Government of India,

Implementation Framework of the Scheme

Implementation and Monitoring

National Steering Committee (NSC): The NSC shall be the Apex Committee constituted by the Ministry of Micro, Small & Medium Enterprises.

The NSC will be empowered to take all major policy and strategy decisions with respect to the implementation of the Scheme and approve any modifications required in the Scheme, like inclusion of further categories of trades.

The committee meeting will be convened at least twice a year for a Scheme-level review, course corrections or to discuss any other agenda as deemed important in the opinion of the committee, as per the requirement.

State Monitoring Committee (SMC):

The SMC shall be responsible for the operational implementation and monitoring of the Scheme at the state level; it will also act as a bridge between the NSC and the field level setup.

District Implementation Committee (DIC)

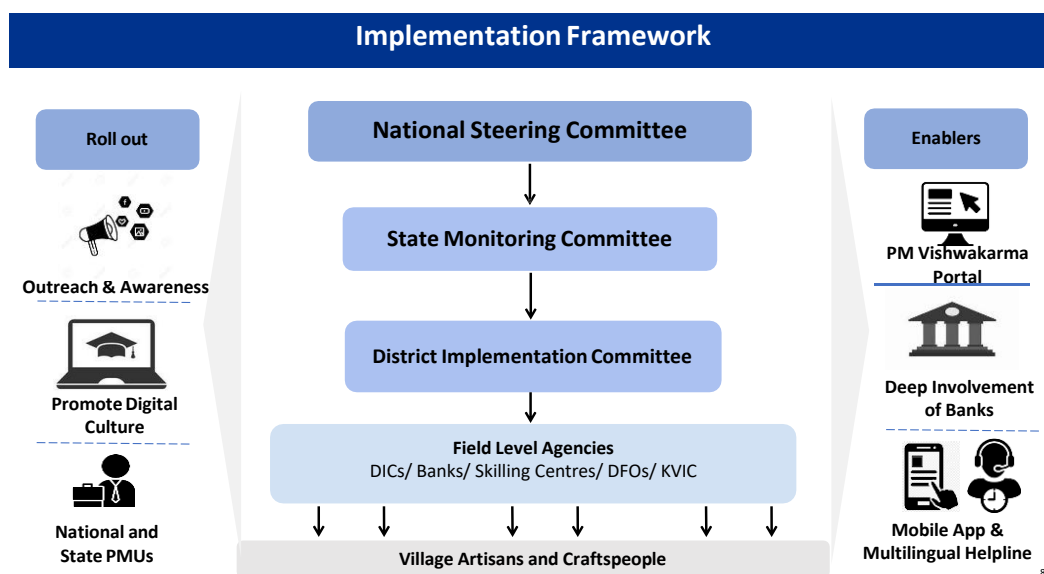
The DIC shall be responsible for the actual roll-out and implementation of the Scheme at the field level and will coordinate with the State Government and other committees.

Executing Agencies: Ministry of MSME, Ministry of Skill Development & Entrepreneurship (MSDE), and Department of Financial Services (DFS).

Monitoring Mechanism

- Programme Management Units (PMUs) at national and state levels for tracking implementation.
- Online Monitoring System (OMS) with dashboards to track fund utilization and beneficiary outcomes.
- Regular Reviews by NSC and SMC to ensure effective execution.

Figure 2. Implementation Framework



Source: Ministry of MSMEs, Government of India

Achievements of the PM Vishwakarma Yojana scheme

Registrations

Against the target of 30 lakh registrations approved for a period of 5 years (FY 2023–24 to FY 2027–28), the Scheme has successfully achieved the target of 30 lakh beneficiaries within just 2 years of its implementation.

Skill Upgradation

As of April 2026, around 23.99 lakh beneficiaries have completed basic skill training.

Toolkit e-Voucher

e-Voucher for the toolkit have been issued to 23.19 lakh beneficiaries.

Collateral-free Concessional Loans

Rs. 4578.40 crore sanctioned to 5.31 lakh beneficiaries in the form of collateral-free loans at concessional rate of interest.

Digital Incentive

Rs. 8.85 lakh beneficiaries are digitally enabled.

Marketing support

Marketing support to the products of Vishwakarma through online platforms such as ONDC, GeM, FABIndia, Meesho and various exhibitions, displays, trade fairs etc. Progress under the various marketing activities conducted since inception till FY 2025-26 is as follows:

- Govt/Private agencies empaneled for marketing support: GeM, ONDC, NID, IRMA, Meesho, Amazon and FabIndia
- Number of applicants onboard GeM: 30,000 +
- Number of applicants Onboarded through ONDC on seller network participants: 1,700 with a cumulative total of 30 transactions completed
- Number of applicants Onboarded on FABIndia: 160, with 20 products cataloged from 9 Vishwakarmas
- Number of Trade fairs organised: 50
- Number of State-level PM Vishwakarma Exhibitions organized: 37
- Number of Vishwakarma received benefits from Trade fair and exhibition: 2,923
- Number of State-level PMUs established: 26
- Number of Vishwakarma trained on E-commerce by Meesho: 1,685 +
- Number of Vishwakarma onboarded on Meesho: 436+

Impact of the PM Vishwakarma Scheme

- ✓ **Economic Empowerment:** Economic empowerment increases the productivity, quality, and scalability of artisans' businesses by providing them with formal recognition, financial support, and easier access to loans.
- ✓ **Cultural Preservation:** In order to maintain heritage-based trades, cultural preservation integrates digital literacy, technological skills, and financial incentives with traditional crafts.
- ✓ **Social Inclusion & Gender Equity:** Encourages inclusivity by assisting underprivileged communities like SCs and STs, and empowers women artisans, especially in rural areas.

Conclusion

By empowering artisans and guaranteeing that traditional trades continue to be viable in a contemporary economy, the PM Vishwakarma plan has the potential to completely change India's artisanal sector. In the future, increasing outreach especially in places with low registration and enhancing financial and digital literacy will be crucial. Participation will be further increased by offering regionalized interventions that are suited to the particular demographics of each state. Furthermore, giving direct access to global and metropolitan markets will assist craftspeople in obtaining fair pricing for their goods, resulting in increased sustainability and profitability. In order to achieve the scheme's objective of developing a sustainable, inclusive, and dynamic artisanal sector that enhances India's economic and cultural legacy, a sustained emphasis on digital empowerment and credit support will give artisans the tools they need to prosper in a cutthroat environment.

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Innovations in Marketing: A Conceptual Analysis of Emerging Practices and their Role in Strengthening Business Transparency

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Abstract

Marketing as a business function has undergone a fundamental transformation over the last decade, driven by digitalisation, changing consumer expectations and the growing emphasis on corporate accountability. This conceptual paper examines the major innovations shaping contemporary marketing practice — including digital and social media marketing, data-driven analytics, green marketing, influencer and content marketing, customer relationship management (CRM) systems, and omni-channel retailing — and evaluates their contribution to business transparency. Drawing on a review of secondary literature, the study develops an analytical framework and comparative table that maps each innovation against its nature, business impact, relevance to transparency and sustainability, and key limitations. The findings suggest that while marketing innovations significantly enhance reach, personalisation and stakeholder engagement, their long-term value depends on authentic and verifiable disclosure practices that align marketing communication with corporate sustainability reporting. The paper concludes with implications for practitioners and directions for future empirical research.

Keywords: *Innovations in Marketing, Digital Marketing, Green Marketing, Business Transparency, Corporate Sustainability, CRM*

1. Introduction

Marketing has evolved from a purely promotional function into a strategic driver of business competitiveness, customer trust and corporate accountability. The proliferation of digital technologies, social media platforms and data analytics has enabled organisations to interact with customers in real time, personalise offerings and build long-term relationships. At the same time, stakeholders — including regulators, investors and consumers — are

increasingly demanding transparency in how businesses communicate their products, pricing, sourcing and sustainability practices. Against this backdrop, innovation in marketing is no longer restricted to novel promotional techniques; it extends to the ethical and transparent use of technology, data and communication channels. This paper explores the spectrum of marketing innovations currently reshaping business practice and examines how these innovations intersect with the broader theme of corporate sustainability reporting and business transparency.

2. Review of Literature

Prior studies on marketing innovation have largely focused on digital transformation, highlighting how social media, mobile applications and e-commerce platforms have altered the marketing mix (product, price, place and promotion). Literature on green marketing emphasises that the credibility of environmental claims depends on transparent and verifiable disclosure, failing which firms risk being perceived as engaging in "greenwashing". Studies on CRM and data analytics point to the dual nature of these innovations: while they enable superior customer insight and personalisation, they simultaneously raise concerns regarding data privacy and ethical use of consumer information. Research on influencer marketing similarly notes that disclosure of sponsored content is central to maintaining consumer trust. Collectively, the literature suggests a converging theme — marketing innovation and business transparency are increasingly interdependent, with the effectiveness of the former often contingent on the credibility of the latter.

3. Objectives of the Study

- To identify and examine the major innovations in contemporary marketing practice.
- To analyse the business impact of each innovation on organisational performance and customer engagement.
- To evaluate the relevance of these innovations to business transparency and corporate sustainability reporting.
- To identify the key limitations and challenges associated with adopting marketing innovations.

4. Research Methodology

This is a conceptual and descriptive study based entirely on secondary data. Information has been compiled from peer-reviewed journal articles, industry reports, and

publications on marketing management, digital transformation and corporate sustainability. A comparative analytical framework has been developed to synthesise the reviewed literature into a structured table, enabling a systematic evaluation of each innovation across four dimensions: nature of innovation, business impact, relevance to transparency and sustainability, and key limitations.

5. Innovations in Marketing: A Conceptual Framework

Marketing innovation can be broadly categorised into technology-led innovations (digital marketing, data analytics, CRM systems, omni-channel retailing) and value-led innovations (green marketing, influencer and content marketing) that respond to shifting consumer values around authenticity and sustainability. Both categories reshape how businesses generate, communicate and deliver value, and both carry implications for how transparently that value is represented to stakeholders. Table 1 presents a comparative analysis of six prominent marketing innovations along these dimensions.

Table 1: Comparative Analysis of Innovations in Marketing

Marketing Innovation	Nature of Innovation	Business Impact	Relevance to Transparency / Sustainability	Key Limitation
Digital & Social Media Marketing	Use of online platforms (social media, apps, influencer channels) to reach and engage customers directly.	Wider reach, lower cost per acquisition, real-time customer feedback and engagement.	Enables open, two-way communication with stakeholders; disclosure of product and pricing information builds trust.	Risk of misinformation and data privacy concerns.
Data-Driven / Analytics-Based Marketing	Application of big data, AI and predictive analytics to understand consumer	Improved targeting accuracy, higher conversion rates, efficient resource allocation.	Data usage policies, when disclosed, enhance accountability but raise transparency	High dependence on data quality; ethical and privacy issues.

	behaviour and personalise offers.		obligations on data handling.	
Green / Sustainable Marketing	Positioning products and brand communication around environmental and social responsibility.	Builds brand equity among environmentally conscious consumers; supports long-term loyalty.	Directly linked to sustainability reporting; requires authentic disclosure to avoid greenwashing.	Credibility depends on verifiable sustainability claims.
Influencer & Content Marketing	Collaborating with content creators to build authentic brand narratives and community trust.	Enhanced brand credibility, niche audience penetration, storytelling-based engagement.	Voluntary disclosure of paid partnerships supports transparent consumer communication.	Regulatory ambiguity on disclosure norms.
Customer Relationship Management (CRM) Innovations	Integrated digital systems to manage and personalise customer interactions across the lifecycle.	Higher retention rates, improved service quality, data-backed decision making.	Transparent handling of customer data strengthens stakeholder confidence.	Requires continuous investment in technology and training.
Omni-channel & Retail Digitalisation	Seamless integration of online and offline retail touchpoints for a unified customer experience.	Improved convenience, cross-channel sales growth, richer customer insight.	Consistent information disclosure across channels reinforces corporate credibility.	Complex implementation and coordination costs.

Source: Compiled by the authors based on review of secondary literature.

6. Role of Marketing Innovation in Enhancing Business Transparency

The analysis in Table 1 indicates that nearly every category of marketing innovation carries a transparency dimension. Digital and social media platforms create open channels for two-way communication, allowing businesses to disclose information and respond to stakeholder concerns in real time. Data-driven marketing, while enhancing personalization, obligates firms to be transparent about data collection and usage practices, aligning marketing ethics with data governance. Green marketing initiatives are only credible when supported by verifiable sustainability disclosures, linking marketing innovation directly to corporate sustainability reporting. Similarly, influencer marketing's legitimacy rests on clear disclosure of sponsored relationships. Taken together, these patterns suggest that the long-term success of marketing innovation is inseparable from an organisation's broader commitment to transparent and accountable business conduct.

7. Challenges in Adopting Marketing Innovations

- Data privacy and ethical concerns arising from extensive use of consumer data.
- Risk of greenwashing when sustainability claims are not backed by verifiable evidence.
- High cost of technology adoption and need for continuous employee training.
- Regulatory ambiguity surrounding disclosure norms for digital and influencer marketing.
- Difficulty in measuring the long-term return on investment of innovation-led marketing initiatives.

8. Conclusion

Innovation in marketing has moved beyond the adoption of new promotional tools to encompass a broader responsibility toward transparent and ethical business communication. Digital marketing, data analytics, green marketing, influencer engagement, CRM systems and omni-channel strategies each offer distinct business advantages, but their sustained success depends on the credibility and transparency with which they are implemented. As stakeholders increasingly scrutinise corporate conduct, businesses that integrate transparent disclosure practices into their marketing innovation strategy are likely to build stronger trust, brand equity and long-term stakeholder relationships. Future empirical research could quantitatively examine the relationship between specific marketing innovations and measures of corporate transparency or sustainability performance across industry sectors.

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Digital Transformation and Sustainable Banking: A Case Study of State Bank of India's Fintech-Driven Green Initiatives

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Abstract

This study examines the interrelationship between digital transformation and sustainable banking practices through a case study of the State Bank of India (SBI), India's largest public sector bank. While a substantial body of literature has documented SBI's institutional and physical green banking initiatives — including solar-powered ATMs, green bonds, and renewable energy financing — the specific role of digital banking platforms as active drivers of sustainability outcomes remains comparatively underexplored. Using secondary data drawn from SBI's Sustainability Reports for FY 2022-23 to FY 2024-25, this study analyses trends in digital adoption (YONO platform registrations, digital transaction share), environmental impact (greenhouse gas emissions avoided, renewable energy capacity), and green finance mobilisation (renewable energy financing, green bond issuance). The findings indicate that digital infrastructure has become a primary, rather than peripheral, driver of the Bank's environmental footprint reduction, with digital transaction share reaching 98 percent by FY 2024-25 and greenhouse gas emissions avoided rising by approximately 15 percent within a single year. The study also identifies a gap in the standardisation and independent verification of digital-specific sustainability metrics, even as SBI's institutional-level green finance disclosures move toward external assurance through mechanisms such as PCAF signatory status. The paper concludes with recommendations for standardising digital-channel sustainability reporting across the Indian banking sector.

Keywords: Sustainable Banking, Digital Banking, Green Banking, ESG, State Bank of India, Fintech, BRSR

1. Introduction

Sustainable banking has emerged as a defining priority for the global financial services industry, driven by mounting regulatory pressure, climate-related financial risk, and growing stakeholder expectations around environmental, social, and governance (ESG) performance. In India, this shift has been reinforced by regulatory mandates such as the Securities and Exchange Board of India's Business Responsibility and Sustainability Report (BRSR) framework, which requires listed companies, including scheduled commercial banks, to disclose standardised sustainability performance data. Within this landscape, the State Bank of India (SBI), as the country's largest public sector bank, occupies a uniquely influential position: its scale means that even incremental improvements in operational sustainability translate into environmental impact at a national level.

Historically, discussions of green or sustainable banking in India have centred on visible, physical interventions — solar-powered ATMs, energy-efficient branch buildings, and green bond issuance. However, the accelerating digitalisation of retail banking, exemplified by SBI's YONO platform and its recent evolution into YONO 2.0 with integrated carbon footprint tracking, suggests that digital infrastructure itself is becoming a direct instrument of sustainability strategy rather than merely a channel through which existing green initiatives are communicated. This raises an important and underexamined question: to what extent is SBI's digital transformation itself functioning as a measurable driver of sustainability outcomes, distinct from the Bank's traditional physical and institutional green banking measures?

This paper addresses this question through a case study of SBI, drawing on three consecutive years of the Bank's official Sustainability Report data (FY 2022-23 to FY 2024-25) to trace the relationship between digital adoption and measurable environmental and financial sustainability outcomes.

2. Literature Review

The transition toward environmentally responsible banking practices has been examined from multiple perspectives in existing scholarship, ranging from conceptual overviews of green banking to institution-specific case analyses. This section reviews the relevant literature across three broad themes: (i) conceptual and global frameworks for green and sustainable banking, (ii) institution-specific studies on SBI and comparative public-private

sector analyses, and (iii) the relatively underexplored role of digital banking platforms as sustainability instruments, before identifying the specific gap this study addresses.

2.1 Conceptual Frameworks for Green and Sustainable Banking

Green banking has increasingly been positioned as a subset of sustainable banking, referring to banking operations, technologies, and financial products that reduce the carbon footprint of banking activities while promoting environmentally and socially responsible business conduct [3]. The concept has evolved alongside international disclosure frameworks, including the recommendations of the Task Force on Climate-Related Financial Disclosures (TCFD) [13], the Global Reporting Initiative (GRI) Sustainability Reporting Standards [14], and the Sustainability Accounting Standards Board (SASB) framework, all of which provide banks with structured methodologies for reporting environmental, social, and governance performance [5].

At the national level, the Securities and Exchange Board of India's Business Responsibility and Sustainability Report (BRSR) framework has institutionalised ESG disclosure requirements for listed Indian companies, including banks, mandating standardised reporting across nine principles of the National Guidelines on Responsible Business Conduct (NGRBC) [11]. This regulatory development has provided the structural basis through which Indian banks, including SBI, now report sustainability performance in a comparable and increasingly standardised format.

Early conceptual work on green banking identified core benefits including reduced deforestation, heightened environmental awareness among staff and customers, and the reorientation of corporate activity toward environmentally beneficial outcomes [3]. Subsequent empirical work extended this conceptual base by examining the relationship between green banking adoption and financial performance, generally finding a positive association between green financing practices and bank profitability, particularly in emerging market contexts such as Bangladesh [4].

2.2 Institution-Specific Studies on SBI and Comparative Analyses

A substantial body of literature has focused specifically on SBI's green banking initiatives, given its position as India's largest public sector bank. Early studies documented

SBI's foundational green banking measures, including the Green Channel Counter, its commitment to carbon neutrality, and its investment in wind farm financing and online money transfer systems as mechanisms for reducing the bank's environmental footprint [1]. Complementing this, subsequent research examined the deployment of physical green infrastructure, most notably SBI's solar-powered ATM network, positioning the bank as the largest employer of solar ATMs in the country, an initiative credited with mitigating carbon emissions by approximately 2,000 tons annually since 2008 [2].

More recent comparative literature has extended this line of inquiry by benchmarking SBI's green banking performance against private sector counterparts, most notably ICICI Bank. These comparative studies generally find that while private sector banks such as ICICI perform strongly in specific areas such as green workspace conversion, SBI demonstrates broader and more extensive green banking initiatives overall, including green bond issuance, green deposit schemes, and a dedicated ESG and Climate Finance unit aimed at achieving net-zero emissions across Scope 1, 2, and 3 by its centennial year [6]. Such comparative work highlights the value of benchmarking public and private sector sustainability strategies but has tended to rely on single-year, annual report-based data, limiting insight into longitudinal trends.

2.3 The Role of Digital Banking Platforms in Sustainability

While the literature on SBI's institutional and physical green banking initiatives is relatively well developed, comparatively less attention has been paid to the role of digital banking platforms as active instruments of sustainability. Existing studies acknowledge SBI's digital initiatives — such as the YONO omni-channel platform, State Bank Buddy wallet, and SBI INTOUCH digital branches — primarily as channels for disseminating awareness about the bank's broader green banking activities, rather than as sustainability mechanisms in their own right [2]. This framing treats digital platforms as a communication or efficiency tool subordinate to the bank's core environmental initiatives, rather than examining digital adoption itself as a measurable driver of resource conservation and emissions reduction.

Broader conceptual reviews of green banking similarly reference digital and retail banking developments — online money transfer, paperless banking, self-operated kiosks — as contributing factors to a bank's sustainability profile, but do not isolate or quantify the specific environmental contribution of digital channel migration relative to other green initiatives [3][5].

2.4 Research Gap

Three gaps emerge from this review. First, while institutional and physical green banking initiatives at SBI have been well documented, digital platforms are generally treated as peripheral or supporting mechanisms rather than as primary drivers of sustainability outcomes, despite recent developments such as YONO 2.0's integrated carbon footprint tracking suggesting digital tools are increasingly designed as direct, consumer-facing sustainability instruments. Second, existing comparative and institution-specific studies rely predominantly on single-year data drawn from annual or sustainability reports, limiting the ability to assess trends over time. Third, while the broader literature raises concerns about the reliability of self-reported green banking disclosures and the associated risk of greenwashing, few studies examine the extent to which digital-specific sustainability metrics are subject to the same standardisation and independent verification increasingly applied to institutional-level green finance disclosures.

This study addresses these gaps by adopting a case study approach that examines SBI's digital-driven sustainability initiatives specifically, drawing on three consecutive years of Sustainability Report data (FY 2022-23 to FY 2024-25) to assess trends, and explicitly evaluating the consistency and verifiability of digital-channel sustainability metrics alongside the Bank's broader institutional green finance disclosures.

3. Objectives of the Study

- To examine the role of SBI's digital banking platforms, particularly YONO, in driving measurable environmental sustainability outcomes.
- To analyse multi-year trends (FY 2022-23 to FY 2024-25) in SBI's digital adoption, environmental impact, and green finance performance.
- To evaluate SBI's ESG and BRSR disclosure practices as they relate to digital transformation.
- To assess the consistency and independent verifiability of digital-specific sustainability metrics relative to institutional-level green finance disclosures.

4. Research Methodology

This study adopts a descriptive, analytical case study approach, focusing exclusively on the State Bank of India. The research relies entirely on secondary data drawn from SBI's official Sustainability Reports for FY 2022-23, FY 2023-24, and FY 2024-25, supplemented

by the Bank's Annual Reports, BRSR disclosures, and relevant regulatory publications from SEBI and RBI. Academic and industry literature on green and digital banking was reviewed to contextualise the findings and identify the research gap addressed by this study.

Data extracted from the three Sustainability Reports were organised into a comparative year-on-year framework across three thematic categories: digital adoption metrics, environmental impact metrics, and green finance metrics. Where reporting units were found to be inconsistent across years, this was noted explicitly as a limitation rather than reconciled through estimation, in order to preserve the integrity of the Bank's original disclosures. A three-year period was selected to balance the need for meaningful trend analysis against the availability of consistently structured, GRI-aligned reporting from SBI.

As a limitation, the study relies on Bank-published data rather than primary survey or interview data, and therefore reflects the scope and granularity of disclosure chosen by SBI itself. This limitation is addressed directly in the Discussion section through an evaluation of the independent assurance mechanisms applied to the Bank's reported figures.

4.1 Scope and Limitations

- Single-institution focus: the study examines SBI exclusively; findings may not generalise to other public or private sector banks without further comparative research.
- Secondary data dependence: all figures are drawn from SBI's own published disclosures rather than independently collected primary data, which may introduce reporting bias despite third-party assurance on select indicators.
- Limited time window: the three-year period (FY 2022-23 to FY 2024-25) allows for short-term trend identification but is insufficient to assess progress against SBI's long-term 2030 and 2055 sustainability targets.
- Inconsistent reporting units: as noted in Section 5.1, changes in the units used to report certain metrics (e.g., paper savings) across years constrain precise longitudinal comparison.
- No primary customer data: the study does not include survey or interview data on customer engagement with digital sustainability features such as YONO's Green Score, which would provide a demand-side perspective absent from this supply-side, disclosure-based analysis.

5. Findings and Results

5.1 Digital Adoption as the Primary Sustainability Driver

The data collected from SBI's Sustainability Reports (FY 2022-23 to FY 2024-25) reveals that digital channel migration has become the single largest contributor to the Bank's environmental footprint reduction. The proportion of transactions conducted through alternate/digital channels rose marginally but consistently, from approximately 97% in FY 2022-23 to 98% in FY 2024-25, indicating that digital banking has reached near-saturation as the default mode of customer interaction at SBI. YONO registrations grew from over 6.07 crore in FY 2022-23 to more than 8.77 crore by FY 2024-25, reflecting sustained platform adoption at scale.

However, the paper-saving metrics reported across the three years show inconsistent units of measurement (metric tonnes of paper in FY 2022-23 versus millions of pages in FY 2023-24 and FY 2024-25), which limits direct year-on-year comparability. This inconsistency itself constitutes a notable finding, pointing to the absence of standardised, comparable metrics for quantifying the environmental benefit of digital banking channels.

5.2 Environmental Impact and Emissions Reduction

Greenhouse gas emissions avoided through renewable energy usage increased from 53,394 MTCO_{2e} in FY 2023-24 to 61,400 MTCO_{2e} in FY 2024-25, a rise of approximately 15% within a single fiscal year. Captive renewable energy capacity more than doubled over the three-year period, from roughly 37 MW (combined solar and wind) in FY 2022-23 to over 46 MWp by FY 2024-25. Similarly, IGBC-certified green buildings nearly doubled, from 32 in FY 2022-23 to 61 in FY 2024-25.

5.3 Scaling of Green Finance

Renewable energy financing more than doubled, from ₹36,243.42 crore in FY 2022-23 to ₹76,736 crore in FY 2024-25, while the financed renewable energy portfolio capacity expanded from 23,679.55 MW to over 38 GW across the same period. Cumulative green and sustainability-linked bonds raised reached USD 2,710 million by March 2025.

5.4 Governance and Disclosure Credibility

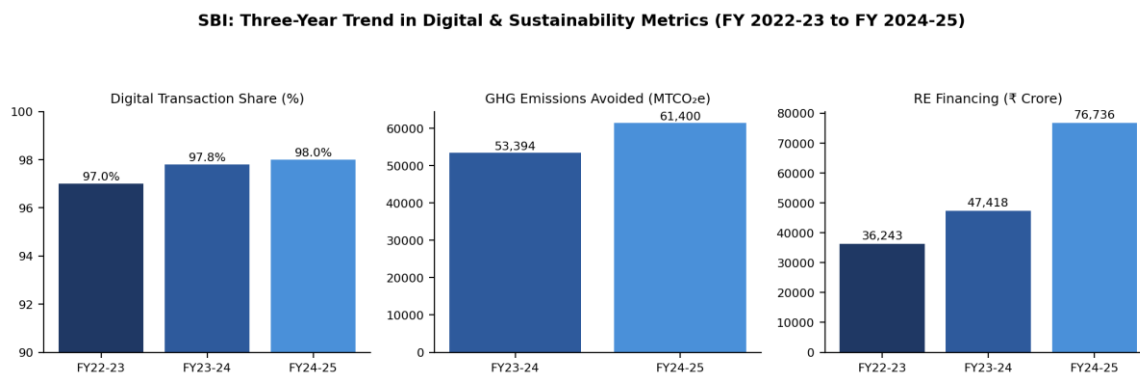
A notable development identified in the FY 2024-25 report is SBI's formal registration as a signatory to the Partnership for Carbon Accounting Financials (PCAF) in February 2025,

alongside the securing of Reasonable Assurance for its BRSR Core indicators from an independent third-party assurance provider. The establishment of a dedicated ESG and Climate Finance Unit, along with formal targets — carbon neutrality for Scope 1 and 2 emissions by 2030, and net-zero across Scope 1, 2, and 3 emissions by 2055 — indicates that digital and environmental initiatives are embedded within a structured, time-bound institutional strategy.

Table 1: Three-Year Trend in SBI Digital Sustainability Metrics

Metric	FY 2022-23	FY 2023-24	FY 2024-25
Digital transaction share	~97%	97.8%	98%
GHG emissions avoided (MTCO ₂ e)	—	53,394	61,400
Renewable energy capacity	>37 MW	>41 MWp	>46 MWp
IGBC green buildings	32	45	61
RE financing (₹ crore)	36,243.42	47,418	76,736
Cumulative green bonds (USD mn)	800	1,050 (approx.)	2,710

Figure 1: Three-Year Trend in SBI's Digital Transaction Share, GHG Emissions Avoided, and Renewable Energy Financing



5.5 Alignment with UN Sustainable Development Goals (SDGs)

SBI's Sustainability Reports explicitly link the Bank's initiatives to the United Nations Sustainable Development Goals (UNSDGs). Table 2 maps the digital and environmental initiatives examined in this study to their most relevant SDGs, illustrating that SBI's digital-driven sustainability strategy contributes to multiple, interlinked global development priorities rather than a single environmental objective.

Table 2: Mapping of SBI Initiatives to Relevant SDGs

SBI Initiative	Relevant SDG(s)	Contribution
YONO digital platform & paperless banking	SDG 12 – Responsible Consumption	Reduced paper and resource consumption
Renewable energy financing & solar ATMs	SDG 7 – Affordable & Clean Energy	Expanded financed renewable energy capacity
GHG emissions avoidance, net-zero targets	SDG 13 – Climate Action	Institutional decarbonisation pathway to 2055
YONO financial inclusion (8.77 crore+ users)	SDG 8 – Decent Work & Economic Growth	Broadened access to formal financial services
Green bonds & sustainability-linked loans	SDG 9 – Industry, Innovation & Infrastructure	Capital mobilisation for green infrastructure

5.6 Comparative Snapshot: SBI and ICICI Bank

While this study's primary focus is SBI, a brief comparative snapshot against ICICI Bank — drawn from existing comparative literature [6] — helps contextualise SBI's performance within the broader Indian banking sector. Table 3 summarises key points of comparison for FY 2023-24, the most recent year for which comparable data across both banks was available in the reviewed literature.

Table 3: SBI vs. ICICI Bank – Selected Green Banking Indicators (FY 2023-24)

Indicator	SBI	ICICI Bank
Renewable energy financed	31,787.66 MW	Not directly comparable (sector-financing model differs)
Green workspace / IGBC-certified area	45 IGBC-certified buildings	~32% of total office area IGBC-certified
Trees planted	18 lakh+	3.7 million (cumulative, multi-year)
Carbon neutrality target (Scope 1 & 2)	By 2030	By 2032

This snapshot suggests that while ICICI Bank demonstrates strong performance in workspace-level green certification, SBI's overall scale of renewable energy financing and its earlier carbon-neutrality target timeline indicate a broader and more time-bound institutional commitment — consistent with prior comparative findings [6]. A full comparative analysis, however, falls outside the scope of this single-institution case study and is proposed as a direction for future research.

6. Discussion

6.1 Confirming and Extending the Institutional Green Banking Literature

The findings of this study are broadly consistent with earlier research on SBI's environmental initiatives [1][2], which documented the Bank's early green banking measures as evidence of institutional commitment to environmental responsibility. The present study's data on renewable energy financing and green bond issuance confirm that this institutional trajectory has not only continued but accelerated significantly in recent years, updating earlier literature with more recent, larger-scale figures.

Where the existing literature predominantly frames green banking in terms of physical and operational interventions, the present findings indicate a meaningful shift in emphasis toward digital-behavioural mechanisms, exemplified by YONO 2.0's carbon footprint tracking and Green Score feature. This addresses the research gap identified in Section 2: existing studies on SBI's green banking undersell the role of digital platforms as active sustainability instruments rather than passive infrastructure.

6.2 Reassessing the Green Banking–Profitability Relationship

Prior research found a generally negative association between green banking disclosure and company value, moderated positively by profitability indicators such as ROA [6]. The present findings — showing sustained growth in SBI's net profit alongside simultaneous, substantial increases in green financing and digital sustainability metrics — are consistent with this moderated relationship, suggesting that for large, well-capitalised public sector banks, sustainability disclosure and digital-green investment may function as complementary rather than competing strategic activities.

6.3 Addressing the Verification and Greenwashing Gap

A recurring limitation noted throughout the green banking literature is reliance on self-reported bank disclosures, raising concerns about reliability and potential greenwashing [5].

The present findings partially address this gap: SBI's FY 2024-25 report discloses Reasonable Assurance for its BRSR Core indicators from an independent third-party assurer, and its PCAF signatory status. Nonetheless, the inconsistency identified in this study's own data — differing units used to report paper and resource savings across years — suggests that verification has not yet extended uniformly to all disclosed metrics, particularly those relating specifically to digital channel impact.

6.4 Positioning Within the Broader Sustainable Banking Framework

SBI's continued publication of GRI-aligned sustainability reports since FY 2015-16, combined with its BRSR compliance under SEBI guidelines, confirms the Bank's alignment with global convergence toward standardised ESG reporting [3][5]. This study's contribution lies in demonstrating empirically, through three years of trend data, that this alignment is not static but shows measurable year-on-year intensification, particularly in renewable energy financing and emissions avoidance.

7. Conclusion and Recommendations

This study set out to examine the extent to which digital transformation functions as a driver of sustainable banking outcomes at the State Bank of India, moving beyond the institution's more widely documented physical and institutional green banking initiatives. The evidence gathered across three fiscal years demonstrates that digital adoption — reflected in near-saturation digital transaction share, sustained YONO platform growth, and the introduction of consumer-facing carbon tracking features — has become structurally interlinked with, rather than peripheral to, SBI's broader sustainability strategy. Parallel growth in renewable energy financing, green bond issuance, and third-party assured ESG disclosure indicates that this digital transformation is occurring within a well-governed, formally targeted institutional framework rather than as an isolated marketing initiative.

At the same time, the study identifies a specific and persistent gap: digital-channel sustainability metrics, such as pages or resources saved through paperless banking, remain inconsistently reported across years and are not yet subject to the same level of independent verification as institutional-level green finance figures. This gap has implications not only for SBI but for the Indian banking sector more broadly, as digital channels increasingly become the primary interface through which sustainability claims reach retail customers.

Based on these findings, the study offers the following recommendations:

- Regulators such as RBI and SEBI should consider developing standardised units and methodologies for reporting digital-channel environmental savings (e.g., paper saved, energy avoided), to enable comparability across banks and over time.
- Banks should extend third-party assurance mechanisms, currently applied primarily to institutional-level green finance disclosures, to cover digital-specific sustainability claims such as carbon footprint tracking features embedded in banking applications.
- Future research should adopt a comparative, multi-bank design to assess whether the digital-sustainability linkage observed at SBI holds across both public and private sector banks, and should incorporate primary data such as customer surveys on engagement with digital sustainability features like YONO's Green Score.
- Policymakers should recognise digital financial inclusion and environmental sustainability as complementary rather than separate policy objectives, given the scale efficiencies demonstrated in this study.

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Conflict of Interest

The authors declare no conflict of interest. This research was conducted independently and was not funded, commissioned, or influenced by the State Bank of India or any other financial institution discussed in this study.

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The Impact of Corporate Sustainability Reporting on Brand Perception and Purchase Intention among FMCG Consumers: A Neuromarketing Perspective

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Abstract

Corporate Sustainability Reporting (CSR) has emerged as an essential strategic communication tool that allows organizations to prove their commitment towards ESG (environmental, social, and governance) aspects while boosting stakeholder trust. Even though prior researches have studied the aspects of sustainability reporting and consumer behavior individually, there is a lack of studies that have combined Corporate Sustainability Reporting with neuromarketing and explained the impact of Corporate Sustainability Reporting on brand perception and purchase intention of consumers in the Fast-Moving Consumer Goods (FMCG) industry. The main aim of the theoretical study is to establish a framework that will describe how Corporate Sustainability Reporting, neuromarketing responses, brand perception and purchase intention interact with each other. This study employs a conceptual research approach and analyzes prior literature on the topics of sustainability reporting, branding, consumer behavior, and neuromarketing. The proposed framework is grounded on the concepts of Stakeholder Theory, Signaling Theory, Stimulus–Organism–Response (S–O–R) Theory, Consumer Decision-Making Theory, and Neuromarketing Theory. It is hypothesized that Corporate Sustainability Reporting will have a positive impact on consumer's emotional and cognitive responses, brand perception, and purchase intention. The framework will contribute to the literature of sustainability reporting and neuromarketing and give the ground for further empirical studies and Marketing communication.

Keywords: Corporate Sustainability Reporting, Neuromarketing, Brand Perception, Purchase Intention, Consumer Behaviour, Sustainability Communication

1 Introduction

1.1 Background of the Study

Over the last two decades, sustainability has become a central element of corporate strategy across industries. Global challenges such as climate change, resource depletion, environmental pollution, and social inequality have encouraged governments, investors, and consumers to demand greater corporate accountability. In response, organizations have increasingly adopted sustainability reporting frameworks such as the Global Reporting Initiative (GRI), Integrated Reporting (<IR>), and Environmental, Social, and Governance (ESG) disclosures. These frameworks enable organizations to systematically communicate their sustainability performance while improving transparency and stakeholder engagement (Global Reporting Initiative, 2021). In the FMCG market, sustainability is a major competitive factor due to the frequent purchases of FMCG goods and presence of many competing brands. The firms use eco-friendly packaging, sustainable procurement, waste management, carbon emissions control, and community development activities to improve their corporate reputation. The sustainability reporting becomes a tool for the effective presentation of such efforts, impacting consumers' perception of corporate responsibility and brand credibility (Aaker, 1991; Porter & Kramer, 2011). The neuromarketing helps to understand the process of sustainability communication since it explains the psychology of consumer behavior. According to the studies in consumer neuroscience, emotional reaction usually takes place before the rational one in the process of making purchase decisions. In this way, the sustainability disclosure, causing consumers' positive emotions like trust, authenticity, and social responsibility, improves brand perception and motivates them to buy sustainable goods. Thus, a neuromarketing approach to understanding the sustainability reporting is quite beneficial theoretically for the FMCG market (Ariely & Berns, 2010; Plassmann et al., 2015).

1.2 Problem Statement

While organizations spend huge amounts of money creating Corporate Sustainability Reports, little is known about how such reporting affects consumer psychological response and purchase behavior. Many sustainability reports concentrate mostly on regulation compliance and stakeholder management; at the same time, their effectiveness in terms of consumer perception formation is poorly understood. Previous studies mainly looked into the connection between sustainability reporting and financial results, corporate reputation, or investor

confidence; consumer behavior, especially in the FMCG industry, was not considered (Eccles, Ioannou, & Serafeim, 2014).

In addition, traditional methods used in marketing research rely much on self-reporting of attitudes and opinions from consumers; in such case, it is difficult to study unconscious emotions affecting purchase behavior. Neuromarketing research offers another approach to studying consumer behavior through examination of emotional and cognitive mechanisms working prior to decision making. At the same time, there are few theoretical studies integrating Corporate Sustainability Reporting into neuromarketing research area and explaining how such information affects brand perception and purchase intention.

1.3 Purpose of the Study

In this regard, the research will seek to establish a framework in which Corporate Sustainability Reporting (CSR) impacts brand perception and purchase intention in the context of neuromarketing in the Fast-Moving Consumer Goods (FMCG). This research paper analyzes the existing literature concerning sustainability reporting, consumer behavior, branding, and neuromarketing in order to determine how the information about the organization's sustainability policies influences the emotions and attitudes of customers, thus affecting their decisions regarding purchases. In addition to that, this research seeks to incorporate several theoretical constructs into one conceptual framework. These constructs include Stakeholder Theory, Signaling Theory, Stimulus–Organism–Response (S–O–R) Theory, Consumer Decision-Making Theory, and Neuromarketing Theory.

1.4 Objectives of the Paper

The objectives of this theoretical study include:

- Discussing the significance of Corporate Sustainability Reporting within the FMCG industry.
- Considering the significance of neuromarketing in understanding the response of consumers towards sustainability communications.
- Discussing the association between Corporate Sustainability Reporting and brand perception.
- Discussing the impact of brand perception on purchase intention of consumers.

- Creating a conceptual model for understanding the association between Corporate Sustainability Reporting, brand perception, and purchase intention from the perspective of neuromarketing.

1.5 Significance of the Paper

The present theory is a valuable contribution to the growing body of research on sustainability reporting since it incorporates notions from neuromarketing and consumer behaviour into the discussion. The theory enriches the knowledge base as it suggests that sustainability communication is not just a means of information delivery but an emotional trigger affecting consumers' attitudes towards brands of companies. In addition, it presents a unique multidisciplinary approach since it combines the notions of sustainability reporting, neuroscience, and consumer behaviour into one theory. In terms of management, the theory gives some useful information to FMCG companies on how to improve brand perception through effective sustainability reporting. Marketing managers can use the suggested framework in order to develop messages for sustainability which will stimulate emotions of their customers and make them willing to buy the products of such companies. In academic terms, the study fills in several research gaps and sets out the way forward for future empirical studies that use neuromarketing methodologies such as eye tracking, electroencephalogram (EEG), fMRI, and biometrics. Therefore, the study forms a basis for future interdisciplinary research on sustainable marketing and consumer neuroscience.

2 Conceptual Foundations

2.1 Corporate Sustainability Reporting

Corporate Sustainability Reporting (CSR) is an accounting practice whereby companies reveal how they perform with respect to their environmental, social, and governance (ESG) issues to stakeholders. CSR goes beyond the conventional accounting by giving stakeholders information on the sustainability efforts, ethical operations, and the creation of long-term value of the organizations. Sustainability accounting has become a critical practice in businesses today as it ensures transparency, accountability, and building stakeholder confidence to enable sustainable development (Global Reporting Initiative [GRI], 2021; IFRS Foundation, 2023). There has been evolution in the way sustainability accounting is practiced today. Initially, the idea of sustainability reporting focused on voluntary disclosure of environmental performance until it became a full-blown accounting practice whereby an

organization can disclose its performance with respect to economic, environmental, and social issues. The idea of reporting sustainability was initiated by Elkington's (1997) Triple Bottom Line that suggested that the success of the company should not be judged only in terms of financial performance but also the economic, environmental, and social performance. Nowadays, in the FMCG industry, Corporate Sustainability Reporting becomes essential due to increased consumers' awareness of environmental protection issues, ethical supply chains, and corporate social responsibility. Transparency of sustainability reports creates credibility and helps consumers find out companies with which they would like to work. As a consequence, firms that disclose sustainability reports successfully create favorable brand perception and stimulate purchase intention of consumers (Porter & Kramer, 2011; KPMG, 2024). Taking into account neuromarketing approach, one can say that sustainability reports act as marketing stimuli and influence subconscious emotions and cognitions of consumers. The messages about sustainability, responsible attitude to environment, and ethics of businesses can evoke consumers' trust, empathy, and positive emotions; consequently, brand perception and purchase intention increase. Thus, Corporate Sustainability Reporting not only is a disclosure tool but also is a determinant of consumer behavior (Lee et al., 2007; Plassmann et al., 2015).

2.2 Brand Perception

Brand perception is an impression or a belief developed by consumers about the brand based on their experiences, communications through marketing and corporate activity. This shows how consumers see the quality and reliability of the brand. A good brand perception helps in developing customer trust and loyalty, thus giving a competitive advantage and becoming a key aspect of consumer decisions. In the FMCG industry, sustainable initiatives and communication of the corporation have become key drivers of good brand perception (Aaker, 1991; Keller, 1993). CSR reporting helps in improving the brand perception through the message communicated regarding the ESG commitment of the organization. Customers now prefer sustainable organizations in order to attach themselves emotionally to the brand. Neuromarketing studies show that sustainable messages are positively evaluated and give rise to positive emotions, which make consumers attach better to the brand (Porter & Kramer, 2011; Plassmann et al., 2015).

2.4 Purchase Intention

Intention to purchase is the measure of the willingness or probability of buying a certain brand or product in the future. It is a behavioral result of the attitude, preferences, and evaluation of the consumers. Factors like product quality, brand trust, price, consumer satisfaction, and organization's reputation play a vital role in determining purchase intention. Based on the Theory of Planned Behavior, favorable attitude towards the brand enhances purchase intention of the consumers (Ajzen, 1991; Kotler & Keller, 2016). Sustainability reporting has a positive impact on the purchase intention as it boosts consumers' trust in the organizational commitment to environment and society. Organizations communicating their efforts of sustainability have a higher probability of purchasing from them. The concept of neuromarketing says that the positive emotions generated due to the sustainability information makes consumers willing to purchase sustainable FMCG products (Global Reporting Initiative, 2021; Ariely & Berns, 2010).

2.5 Neuromarketing

Neuromarketing refers to a multi-disciplinary approach, which involves neuroscience, psychology, and marketing to understand the unconscious reactions of consumers to marketing stimuli. As opposed to traditional methods of marketing research, neuromarketing makes use of tools like EEG, fMRI and eye-tracking in order to study the information processing and purchasing behavior of consumers. This helps marketers to learn about the psychological elements influencing consumer behavior (Lee, Broderick, & Chamberlain, 2007; Morin, 2011). From the perspective of sustainability, neuromarketing can explain why sustainability communications trigger emotions, attention and memory in consumers, thus affecting their perception of brands and purchase intention. Therefore, neuromarketing offers important insight into the psychological mechanisms by which Corporate Sustainability Reporting affects the behaviour of consumers in the FMCG industry (Plassmann et al., 2015; Ariely & Berns, 2010).

3 Theoretical Foundations

3.1 Stakeholder Theory

Stakeholder Theory was introduced by Freeman (1984) that organizations should create value not only to the shareholders but also for all the stakeholders like customers, employees, investors, suppliers, government and society. The theory emphasizes that organizations are

responsible for their economic, environmental and social impact and should transparently report these responsibilities. Corporate sustainability reporting is a key mechanism through which organizations disclose their sustainability initiatives and demonstrate accountability to stakeholders. Transparent reporting builds trust with stakeholders and enhances a corporation's reputation, especially among consumers who are increasingly valuing responsible business practices. Therefore, Stakeholder Theory offers a good basis to understand why organizations engage in sustainability reporting and how these disclosures influence consumer perceptions (Freeman, 1984; Donaldson & Preston, 1995).

3.2 Signalling Theory

Spence (1973) proposed Signaling Theory to explain how organizations reduce information asymmetry by sending credible signals to stakeholders. In the world of sustainability, Corporate Sustainability Reporting is a good sign that a company is committed to environmental protection, ethical governance and social responsibility. Consumers are interpreting these sustainability disclosures as signals of corporate credibility and trustworthiness which have positive impact on their perceptions about the brand. Good sustainability reporting decreases uncertainty, improves brand image and promotes positive purchasing decisions. Signaling Theory is highly relevant as it explains how sustainability information influences consumer evaluations prior to purchase decisions (Spence, 1973; Connelly et al., 2011).

3.3 Stimulus–Organism–Response (S-O-R) Theory

The Stimulus – Organism – Response (S-O-R) Theory was developed by Mehrabian and Russell (1974) and outlines the effect of external environmental stimuli on the internal psychological state of the individual, which in turn effects behavioural responses. The stimulus in this study is Corporate Sustainability Reporting which provides consumers with information about a company's sustainability activities. The organism is the consumers' emotional and cognitive evaluation (brand perception) and the response is the purchase intention. From a neuromarketing point of view, sustainability disclosures evoke emotional responses such as trust, empathy and perceived authenticity, which positively affect consumers' purchase intention. Thus, the S–O–R framework is a good explanation of the psychological process connecting sustainability reporting and consumer behaviour (Mehrabian & Russell, 1974; Plassmann et al., 2015).

3.4 Theory of Planned Behavior (TPB)

Ajzen (1991) proposed the Theory of Planned Behavior (TPB) which describes the attitude, subjective norms and perceived behavioral control of an individual to affect their behavioral intention. In marketing research, purchase intention is considered the direct antecedent of actual purchase behaviour. Sustainability reporting builds a positive brand image and can generate more favorable attitudes towards the brand by the consumers and consequently greater intention to purchase the brand's products. The theory suggests that consumers are more likely to develop positive attitudes and behavioural intentions towards a company when they perceive the company to be socially and environmentally responsible. Hence, the TPB offers a valuable framework to comprehend the effect of sustainability communication on purchase intention in the FMCG industry (Ajzen, 1991; Kotler & Keller, 2016).

3.5 Brand Equity Theory

The Brand Equity Theory proposed by Aaker (1991) suggests that the value of a brand is based on consumers' perceptions, including brand awareness, perceived quality, brand association and brand loyalty. Corporate Sustainability Reporting which communicates positive sustainability initiatives improves these dimensions by increasing the confidence of consumers in the brand. Consumers develop stronger emotional bonds and trust when companies are perceived as ethical and environmentally responsible, which increases brand equity. Later, higher brand equity influences consumers' purchase intention by differentiating the brand from competitors and reducing perceived purchase risk (Aaker, 1991; Keller, 1993).

3.6 Consumer Decision-Making Theory

The theory of consumer decision making explains how consumers recognize their needs, search for options, choose the right one to buy and reflect on their satisfaction after consumption. As per Kotler and Keller, the decision-making process has five stages which are need recognition, information search, evaluation of alternatives, purchase decision and the post-purchase behavior. The process starts when consumers realize the fact that something is required and they are facing some problem. They start looking for various options in different ways including advertisements, their own experiences, social media, internet reviews, and the corporate messages from companies to analyze the options available. After buying and using the product, consumers decide if it meets their expectations. This decision affects their

satisfaction, brand loyalty, and future buying habits. In the context of Corporate Sustainability Reporting, clear sustainability disclosures offer helpful information that guides consumers in their decision-making. Sustainability reports lessen information gaps, improve brand credibility, and positively affect consumers' evaluations. This, in turn, boosts purchase intention and long-term brand loyalty (Kotler & Keller, 2016; Solomon, 2020).

3.7 Neuromarketing Theory

Neuromarketing Theory brings together neuroscience, psychology, and marketing to explain how unconscious brain processes affect consumer buying behavior. Unlike traditional marketing methods that depend on what consumers say, neuromarketing looks at the emotional and mental processes involved in decision-making. The emotional brain, especially the limbic system, is key in creating feelings like trust, empathy, excitement, and satisfaction. These feelings often guide purchasing decisions before logical thinking kicks in. The cognitive brain, linked to the prefrontal cortex, handles logical thought, processes information, and assesses product features. Effective marketing communication grabs consumers' attention, improves memory, and triggers the brain's reward system, which helps build positive connections with a brand. Messages about sustainability that highlight environmental care, ethical practices, and social responsibility can evoke positive emotions, enhance brand image, and boost the likelihood of making a purchase. Thus, neuromarketing offers a useful lens for understanding how Corporate Sustainability Reporting impacts consumer behavior by engaging both emotional and mental processes in the FMCG market (Lee, Broderick, & Chamberlain, 2007; Morin, 2011; Plassmann et al., 2015).

4 Literature Synthesis And Research Gap

4.1 Corporate Sustainability Reporting and Consumer Behaviour

Corporate Sustainability Reporting has become an important tool for improving corporate transparency and building stakeholder relationships. Previous studies show that organizations that share their environmental, social, and governance (ESG) efforts through sustainability reports are more likely to create positive brand perceptions among consumers. Transparent reporting shows corporate responsibility, ethical business practices, and a long-term commitment to sustainability. This increases consumer trust and brand credibility. Consumers often see sustainability disclosures as a sign of organizational integrity, leading to positive brand evaluations and stronger emotional connections (Porter & Kramer, 2011; Eccles

et al., 2014). However, some researchers argue that the effectiveness of sustainability reporting relies on its credibility and authenticity. Consumers may form negative views if they see sustainability disclosures as greenwashing or marketing tactics instead of real corporate commitments. Therefore, organizations must ensure that sustainability reports accurately reflect their environmental and social performance to enhance brand perception and stakeholder confidence (Delmas & Burbano, 2011; Hahn & Kühnen, 2013).

4.2 Sustainability Reporting and Brand Perception

A previous stream of research has indicated that the reporting of CSR has a positive effect on consumers' buying decisions due to increasing the reputation and also reducing information asymmetries of the firm. Consumers seem to buy products from companies which practice social responsible behaviors (social sustainability), such as helping environment (environmental sustainability), using fair products (ethical sourcing), caring for the people (social accountability), and disclosing this information by reporting their sustainability performance (Eccles et al., 2014; GRI, 2021). But studies also shows that the actual consumption is not necessarily influenced directly by the existence of a CSR report. Sustainability reports are likely to have a positive effect on consumption if consumer attributes are favorable in terms of concern, trust and perception of validity (Kotler & Keller, 2016; Ajzen, 1991).

4.3 Sustainability Reporting and Consumer Trust

One of the primary driver of sustainable success in the long-term is to earn and sustain consumer trust in any industry, especially those industries in which sustainability practices and consumer desire for transparency on corporate's sustainability performance and its initiatives are becoming paramount for any firms. Thus, it makes sense to conclude that Corporate Sustainability Reporting (CSR) boost firm's credibility through offering truthful data related to corporate's ESG. Clear and informative sustainability disclosure diminish informational asymmetric gap, boost organization credibility, and enable strong, lasting consumer-business relationships. The results from recently published papers confirmed the role that good-quality disclosures played on enhancing consumer trust, and thus, on consumers perception of firm's sincerity and the trust level on various stakeholders in general, while conversely bad quality of reporting (greenwashing or fake disclosure of CSR performance) does weaken consumer's trust toward firms and has negative impacts (Riva et al., 2024; Alhumud et al., 2025).

4.4 Neuromarketing in Sustainable Marketing

Neuromarketing offers a unique approach to decoding consumers' subconscious response to sustainability-linked communication. Neuromarketing allows organizations to assess the implicit emotional and cognitive responses that may be lost in traditional research methods. Green, Ethical and Fair-Trade sustainability messages elicit the right feelings that contribute to sustainable behaviour such as trust, warmth and moral sentimentality. Furthermore, neuromarketing research shows that these techniques may offer to companies insights to improve the persuasive sustainability communication and sustainable brand communication engagement with consumers (irovi et al., 2024; Jani et al., 2022).

4.5 Neuromarketing and Brand Perception

Consumers' processing of the emotional and cognitive aspects of marketing stimulus can significantly affect their overall perception of the brand. As neuromarketing suggests, sustainability reports, eco-labels, ethical ads, and green packaging increase the neural activity of attention, memory, and emotional assessment; thus, enhancing a favorable image of a brand. A positive emotional perception towards sustainability endeavors will create favorable brand perceptions concerning trust and genuineness and will improve the social perception of the brand. This has recently been empirically proven by neuroscience based communication on sustainability and how it improves both brand credibility and consumers' judgments (irovi et al., 2024; Riva et al., 2024).

4.6 Brand Perception and Purchase Intention

Perception of brand helps to drive purchase intention as a result of favorable perceptions to minimize risk and increase confidence. Customers are attracted to brands who are ethical, environmental-friendly and have a tendency to shop from brands who offer a good sense of confidence. ESG disclosures may serve to boost brand credibility and as result influence their consumers purchase intention. The FMCG companies, who has been able to create favorable brand perceptions are able to attract a niche market which are conscious about their environment. Influence of ESG Disclosures on Consumer Brand Perceptions and Behavioral Intentions, 2024) (Borah et al., 2024).

4.7 Sustainability Communication and Purchase Intention

In terms of sustainability communications' effect on consumer buying intention, they positively contribute to enhancing consumers' awareness about sustainable behaviors and

corporations' values. Transparent sustainability communication such as through sustainability reports, ESG communications, environmental labels and online channels gives opportunities for consumers to assess a firm's responsibility in environment and social issues. The latest findings indicate that transparency in communication contributes to consumer trust in green products, strengthening brand reputation, and affecting consumer purchase intentions. More and more consumers want to do business with firms which disclose genuine and trustworthy information about sustainability (Borah et al., 2024; Cho et al., 2024).

4.8 Research Gaps

Existing research has largely researched on corporate sustainability reporting, consumer trust, brand perception and purchase intention separately. For instance, most studies focus on corporate's financial performance, the quality of disclosure on ESG or on corporate reputation, and rarely consider the Psychological pathways to consumer behaviour from corporate sustainability reporting. More recently, neuromarketing have been applied to studies of sustainability in the hope of capturing consumers' underlying emotion towards corporate sustainability information, however, the applications are few. This study propose a holistic conceptual framework, including CSR disclosure, neuromarketing, brand perception and purchase intention and, the relevance of the model specifically for FMCG companies is high (irovi et al., 2024; Influence of ESG Disclosures on Consumer Brand Perceptions and Behavioral Intentions, 2024).

5 Development of the Conceptual Framework

5.1 Linking Corporate Sustainability Reporting with Brand Perception

Previously, Corporate Sustainability Reporting (CSR) was seen to be a mandatory disclosure requirement rather than an important communication strategy; it informs customers about companies' environmental, social, and governmental (ESG) initiatives. The disclosures allow the customers to check if the company has ethical values and conducts its operations in an ethical way. When sustainability disclosures are authentic and genuine, customers are more inclined to trust in the brand, consequently affecting brand perception in a positive way. It has been found through recent research that ESG disclosures improve credibility, corporate reputation, and consumer trust, particularly the group of eco-focused customers (Riva et al., 2024; KPMG, 2024). Thus, Corporate Sustainability Reporting will have a positive impact on customer perceptions of FMCG brands.

5.2 Neuromarketing Perspective

The application of neuromarketing offer insights into consumer brain responses, which cannot be revealed by traditional survey or research methods based on consumer self-reports (e.g. Attitudes). The human consumer brain consists of emotional responses, attentional, Memory, as well as reward system which all have a great effect on human purchasing decisions (Lee et al., 2007; Plassmann et al., 2015; Plassmann & van de Ven, 2015). Communication of the environmental friendly production methods, the fairness of sourcing process, and socially responsible behaviors trigger subconscious human emotional responses like pride, trustworthiness, and empathy. Subconscious emotions make consumer connected more with sustainable products or brands, affect the attitude of consumer's judgment on CSR activities (Irovi et al., 2024). The research in recent studies indicated that the application of neuroscience to marketing of sustainability would enhance communication efficacy for consumer and firms through the stimulation of emotional ties between the two (irovi et al., 2024).

5.3 Brand Perception as a Mediator

Brand perception acts as the mechanism through which the Corporate Sustainability Reporting can be effectively used for bringing about positive outcomes in consumer behaviour. It is through changing how consumers perceive the brand that the organisation can positively impact their purchase intentions based on its Sustainability disclosures. Consumers' perception regarding the reliability, trustworthiness, genuineness, and responsibility of the company increases with every communication made about their sustainable activities and, in turn, increases the purchase intentions towards that company's products and services. Existing literature confirms that brand perception mediates between communication about sustainability efforts and the actual behaviour of the consumer and as such plays a role as a mediating variable in sustainable marketing (Gurung & Sarkar, 2024; Riva et al., 2024).

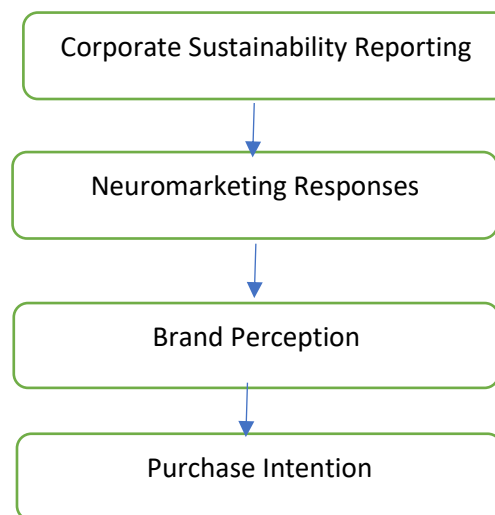
5.4 Purchase Intention

Consumers' willingness to purchase the product/brand in the future, purchase intention is also believed to be a powerful determinant of consumers' buying behaviour. Consumers want brands that are responsible towards social and environment. They favor firms that actively report on social and environmental activities, and these can improve their confidence towards brand as reduce purchase risk, eventually boost the purchase intention. The sustainable communication has the ability to build the positive perception of the consumers about brand

and improve trust on brand which influence purchase intention. Several studies show that sustainability communication, trust, and positive perception of brand collectively can increase consumer purchase intention especially among environmentally oriented consumers within FMCG sector (Borah et al., 2024; Cho et al., 2024).

5.5 Conceptual Framework

Based on theoretical underpinnings and review of literature, the conceptual framework conceptualized suggests how Corporate Sustainability Reporting influences consumer purchase intention by means of the mediation of neuromarketing response and brand perception. The study posits that Corporate Sustainability Reporting functions as the input marketing stimulus, representing an firm's sustainability endeavors to the consumers. Neuromarketing illuminates how the subconsciously processing of consumers with regards to CSR messages would yield emotions, attention, memory and reward system response, which consequently will lead to the perception of the consumer toward a brand and therefore leads to purchasing intention. Therefore, the model highlights the integrated of sustainability report with the understanding from neuromarketing to explain the phenomenon of consumer sustainable purchase behavior in the context of FMCG industries.



5.6 Propositions

P1: The reporting of Corporate Sustainability has a positive effect on brand perception in the minds of customers

P2: The reporting of Corporate Sustainability affects brand perception through neuromarketing processes.

P3: Consumers tend to exhibit a greater purchase intention toward a brand with positive brand perception.

P4: The reporting of Corporate Sustainability influences customer purchase intentions, through the mediation effect of brand perception.

P5: The neuromarketing can offer a theory to justify the effect of sustainable communications on customer decision-making processes

6 Discussion

6.1 Theoretical Contributions

In summary, the current research offers an integrated framework of Corporate Sustainability Reporting (CSR), neuromarketing, brand perception, and purchase intention, based on prior researches which were focused on isolated concept. Specifically, the present study proposes the linkage between these concepts from consumer behaviour perspectives. Extending stakeholder, signalling, Stimulus-Organism-Response (S-O-R), and Consumer Decision-Making Theory, this study sheds the light upon the function of CSR communications as the stimulus of marketing activities in affecting the emotions of the consumers. Moreover, applying neuromarketing perspective allows understanding subconscious reaction triggered by corporate sustainability disclosures on consumers' perception and intention. (irovi et al., 2024; Riva et al., 2024).

6.2 Managerial Implications

The proposed model can assist marketing managers and other business leaders to improve consumer relations through sustainability strategies. Rather than as an issue of compliance, companies can use sustainability reporting as a strategic marketing tool that builds trust and strengthens brand equity. It is important to ensure reports are truthful and credible, and accessible to consumers, while clearly showcasing actual environmental and social projects. Using neuromarketing in the communications about sustainability may create a powerful communication strategy that will help capture the attention, raise brand awareness, and influence buying intentions. This can potentially increase customer loyalty and offer a long-term competitive advantage in a consumer market with a rising consciousness towards sustainability (KPMG, 2024; Borah et al., 2024).

6.3 Implications for FMCG Companies

The rising tide of concern for environmental and social well-being is making consumers place greater value on the sustainability of products. The suggested strategy indicates that FMCG companies should use their brand and marketing endeavors to express their environmentally friendly activities, such as the reduction of waste, the reuse of packaging materials, the reduction of carbon emissions, the responsible use of materials and support to local community. Such activities on corporate sustainability reporting, packaging design, advertisement campaigns and media promotion can reinforce the perception of consumers. The integration of principles of neuromarketing helps the marketers construct emotion based message of sustainability for consumption. It drives consumers make a sustainable purchasing decision instead of a rival brand, enhances brand competitiveness, as well as develops the customer loyalty (Cho et al., 2024; Gurung & Sarkar, 2024).

6.4 Policy Implications

In addition to being of interest to researchers, these conceptual study results have policy, regulatory and sustainability standard-setter implications. The need for policy and regulation to push corporations towards international standards in reporting such as the Global Reporting Initiative (GRI) standard, the International Sustainability Standards Board (ISSB) and national standards for sustainability reporting. Governments should continue to push to minimise 'green-washing', increase disclosures and the credibility of reporting, creating a space to build consumer confidence and promote more responsible company behaviour, while initiatives in public awareness for consumers will further their ability to understand sustainability reports (IFRS Foundation, 2023; KPMG, 2024).

6.5 Future Research Directions

Although this study establishes a well-rounded conceptual framework, its relationships would require empirical testing. Future research may employ SEM or PLS-SEM to quantify relationships in the conceptual model. Comparative studies using varied industries, countries, or demographic segments might prove insightful regarding the varying impact of sustainability reporting on consumer behaviour. There are likely further mediators or moderators that might be studied in the future, for example: trust in companies, level of concern about environmental issues, green brand image, perceived authenticity, and level of sustainability knowledge. Furthermore, developments in neuroscience tools such as eye tracking, EEG, fMRI and facial

emotion recognition might be utilised in order to explore consumers subconscious perceptions to sustainability communication empirically and further cement neuromarketing within sustainable marketing research (irovi et al., 2024; Plassmann et al., 2015).

7 Conclusion

7.1 Summary of Key Arguments

Corporate Sustainability Reporting, Brand Perception, Purchase intention, and Neuromarketing for the FMCG Sector This is an theoretical paper addressing the relationship between Corporate Sustainability Reporting (CSR), Brand Perception, Purchase intention, and Neuromarketing in the FMCG sector. Corporate Sustainability Reporting was argued to transform from being a reporting regulation and a means of disclosure to a communication instrument of marketing strategy in driving consumer behavior. Through drawing upon theories including Stakeholder theory, Signaling theory, Stimulus-organism response (S-O-R) theory, Consumer Decision Making theory, and Neuromarketing theory, the study proposes a general model where the publication of sustainability reports is found to enhance positive cognitive and emotional consumer response by contributing to favorable brand perception, which ultimately contributes to increased purchase intent. Brand perception plays a mediating role and the present model shows a need for neuromarketing in explaining consumer's subconscious responses toward sustainability communications (irovi et al., 2024; Riva et al., 2024).

7.2 Contribution to Sustainability Reporting Literature

The sustainability reporting literature often goes no further than organizational governance and financial performance reports in the discussion on the topic. Research has mostly concentrated on how sustainability reporting influences organizations and their investors or regulations and firm performances. In this study, sustainability reporting will be tested as a consumer related marketing strategy by offering a conceptual framework showing how clear sustainability reports may build brand credibility, customer loyalty and consumer purchase intention for an FMCG firm. The study combines sustainability reporting literature with consumer related psychology literature and brand research, enriching the sustainable accounting/management/marketing scope, and providing a basis for a follow-up research project with more extensive empirical data (KPMG, 2024; IFRS Foundation, 2023).

7.3 Contribution to Neuromarketing Literature

Also, the paper makes a contribution to neuromarketing research which studies to what extent and how can neuroscience shed more lights on the communication of sustainability and consumer choice. To date, the application of neuromarketing in the context of consumer purchasing decisions, particularly with regards to marketing strategy, mostly addresses ad effectiveness, packaging, price, brand management and the brand name. This research paper adds value by extending application of neuromarketing to corporate sustainability reporting and proposes that consumers' emotions processing, attention, memory as well as reward systems can be influenced when exposed to the company's sustainability information, thus changing consumers' perception towards the brand, and increasing their purchase intention. This multi-disciplinary integration provide us with an emerging theoretical perspective combining neuroscience with sustainability and marketing, thus provides future research directions with more to be investigated via the application of neuromarketing tools such as eye-tracking, EEG, and fMRI (irovi et al., 2024; Plassmann et al., 2015).

7.4 Conclusion

Overall, it has been established that the corporate sustainability reporting has served as a key strategic communication method for FMCG companies that shapes their consumers' perception and purchase decision process. In today's world, FMCG organizations have been seen to prefer brands which authentically represent their corporate social and environmental commitment, which is communicated through their corporate sustainability disclosure. With the lens of neuromarketing, we have further confirmed that sustainability communication affects consumers not only in the cognitive processing of evaluation but also subconsciously in terms of their emotional response thereby impacting on brand image and consumer purchase intention. The Conceptual Framework proposed, offer the integration of the underlying relationships into one model thereby providing a well-supported theoretical explanation and managerial implications. It is evident that by leveraging on the application of neuromarketing in sustainable communication, Conclusion Thus, from the theoretical perspective presented above, one may conclude that CSR is not only a transparency tool but also a strategic communication approach that can affect the emotional and cognitive reactions of consumers. Combining sustainability reporting with neuromarketing helps improve the understanding of brand perception and purchase intention in the FMCG industry. This conceptual framework will provide an excellent basis for further research in this area. (Borah et al., 2024; Riva et al., 2024)

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Digital Signature Authentication and Fraud Prevention in AI – Based Net Banking among Bank Customers in Chengalpattu District

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Abstract

Artificial Intelligence (AI) has transformed the banking sector by improving the security and efficiency of net banking services. Digital signature authentication is an important security mechanism that verifies user identity, protects data integrity, and prevents unauthorized access. However, the growing use of digital banking has also increased the risk of cyber fraud, including phishing, identity theft, and online financial fraud. This study examines the role of digital signature authentication in preventing fraud in AI-based net banking among bank customers in Chengalpattu District. It highlights the importance of AI-driven fraud detection, secure authentication, and customer awareness in ensuring safe online banking transactions. The study provides theoretical insights into strengthening digital banking security and enhancing customer trust in AI-enabled banking services.

Keywords: Artificial Intelligence, Digital Signature Authentication, AI-Based Net Banking, Fraud Prevention, Cybersecurity, Online Banking, Customer Security, Chengalpattu District

Introduction

Digital banking has become an important part of modern banking services. Net banking allows customers to perform banking activities such as fund transfers, bill payments, and account management anytime and anywhere. Although these services offer convenience, they also increase the risk of online fraud, cyber attacks, and unauthorized access. To improve the security of online transactions, banks have introduced digital signature authentication to verify customer identity and protect transaction data. In addition, Artificial Intelligence (AI) helps

banks detect unusual transaction patterns and prevent fraudulent activities in real time. These technologies improve the security of net banking and strengthen customer confidence in digital banking services. Therefore, this study focuses on digital signature authentication and AI-based fraud prevention among net banking customers in Chengalpattu District.

Review of Literature

Meena and Rathina (2022)¹ This study examined digital banking adoption and customer satisfaction in Kanyakumari District. Primary data were collected from 100 respondents using structured surveys, and percentage analysis, chi-square, and F-tests were applied. Results revealed that while customers appreciated the time-saving and convenient aspects of digital banking, several challenges, including security concerns and technical difficulties, affected satisfaction. It concluded that understanding customer preferences and addressing usability and security issues are key to increasing engagement and trust, enabling banks to deliver effective digital financial services that meet consumer expectations in both urban and semi-urban areas.

Helen and Arief et al. (2025)² The research study investigated the factors influencing customers' behavioral intention to use AI-enabled digital banking services. The aim of the study was to examine the influence of corporate reputation, customer trust, and feature usefulness on behavioral intention through customer attitude. The study adopted a quantitative research approach. A purposive sampling technique was used to select 350 digital banking users. Data were collected through a structured questionnaire using a Likert scale. The collected data were analyzed using PLS-SEM and Smart PLS software. Customer attitude was found to positively affect behavioral intention to use AI-enabled digital banking services. The study recommended that banks improve their reputation, strengthen customer trust, and develop useful AI-powered features. The researchers concluded that customer attitude plays a significant mediating role in promoting the adoption of AI-enabled digital banking services.

Poonam Saini and Arjun Khateek (2026)³ The research study analysed effectiveness of AI in transaction monitoring, real-time fraud alerts, suspicious activity identification, accuracy, efficiency, and customer trust. The study adopted a quantitative research design using a structured questionnaire with 15 Likert-scale statements. Primary data were collected from 318 digital banking users. The data were analyzed using descriptive statistics, reliability

analysis, one-sample t-test, and one-way ANOVA. The findings revealed that respondents had a favourable perception of AI-driven fraud detection systems, with younger users showing more positive views than older users. The study concluded that AI-driven banking technologies significantly enhance fraud detection in digital banking and improve customer confidence, while age influences users' perceptions of these technologies.

Objectives of the Study

1. To analyze customer awareness of digital signature authentication in net banking.
2. To identify the role of AI in fraud prevention.
3. To evaluate customer trust in AI-based net banking security systems.
4. To assess the relationship between digital signature authentication and customer confidence.

Scope of the Study

The study focuses on digital signature authentication and fraud prevention in AI-based net banking among bank customers in Chengalpattu District. It examines customers' awareness, perception, and usage of digital signature authentication. The study also analyzes the relationship between demographic variables and customer opinions on digital banking security. The findings are limited to the selected respondents and the study area. The results may help future researchers conduct similar studies in other regions. The study also provides useful information for banks and policymakers to improve digital banking security.

Importance of the Study

The study highlights the importance of digital signature authentication in ensuring secure AI-based net banking services. It helps banks understand customer perceptions of digital banking security. The findings support financial institutions in developing effective fraud prevention strategies. The study also creates awareness among customers about secure online banking practices. It contributes to the existing literature on AI and digital banking security. The results may assist researchers, bankers, and policymakers in improving secure digital financial services.

Methodology

The study adopted a descriptive research design with a quantitative approach. The research was conducted among bank customers in Chengalpattu District. A total of 120

respondents were selected using the convenience sampling method. Primary data were collected through a structured questionnaire, while secondary data were obtained from books, journals, reports, and websites. The collected data were analyzed using SPSS with statistical tools such as Percentage Analysis, Descriptive statistics, Independent Sample t-Test, One-way Anova, Chi-Square Test and Correlation Analysis. The findings were interpreted to achieve the objectives of the study and draw valid conclusions.

Data Analysis and Interpretation of the Study

Table – 1: Demographic Profile of the Respondents

Gender Wise Distribution		
	No. of Respondents	Percentage %
Male	61	50.8
Female	59	49.2
Total	120	100.0
Age Wise Distribution		
Below 25 Years	68	56.7
25 – 35 Years	33	27.5
36 – 45 Years	12	10.0
46-55 Years	5	4.2
Above 55 Years	2	1.7
Total	120	100.0
Educational Qualification Wise Distribution		
School level	7	5.8
Undergraduate	71	59.2
Postgraduate	28	23.3
Professional	9	7.5
Others	5	4.2
Total	120	100.0
Occupation Wise Distribution		
Government Employee	5	4.2

Private sector Employee	53	44.2
Business	13	10.8
Retired	2	1.7
Others	47	39.2
Total	120	100.0
Monthly Income Wise Distribution		
Below Rs.25,000	76	63.3
Rs.25,001 – Rs.50,000	30	25.0
Rs.50,001 – Rs.75,000	9	7.5
Above Rs.75,000	5	4.2
Total	120	100.0
Marital Status Wise Distribution		
Un Married	79	65.8
Married	41	34.2
Total	120	100.0
Type of Family Wise Distribution		
Nuclear Family	71	59.2
Joint Family	49	40.8
Total	120	100.0

Source: Primary data

Table-2 Level of AI-Based Fraud Prevention of Mean and Standard Deviation

Level of AI-Based Fraud Prevention	Mean	Std. Deviation
Fraudulent activities are detected promptly.	3.93	.945
Suspicious transactions are identified accurately.	3.70	.856
Risk monitoring is effective.	3.87	.879
Real-time alerts improve security.	3.98	.840

Cyber threats are minimized.	3.87	.859
Transaction monitoring reduces fraud risks.	3.83	.853
Intelligent systems strengthen security.	3.94	.833
Fraud prevention measures are effective.	3.79	.859

Source: Primary data

The descriptive statistics were analyzed based on a sample size of 120 respondents. Table -2 presents the mean scores (3.70–3.98) indicate a high level of agreement with AI-based fraud prevention. The highest mean was for "Real-time alerts improve security" (Mean = 3.98, SD = 0.840), while the lowest was for "Suspicious transactions are identified accurately" (Mean = 3.70, SD = 0.856). Overall, the findings show that respondents have a positive perception of AI-based fraud prevention in net banking.

Inferential Analysis

Table-3: t test for significant differences between Unmarried and married with respect to Factors of AI- Based Net Banking Security

Factors of AI-Based Net Banking Security	Un married		Married		t-value	p-value
	Mean	Std. Deviation	Mean	Std. Deviation		
Digital Signature Authentication	31.4810	5.53974	34.0244	3.92739	-2.616	0.010**
AI-Based fraud Prevention	30.2658	5.19790	32.1463	3.80500	-2.048	0.043*
Security Confidence	30.2658	5.68558	32.6341	5.56173	-2.317	0.022*
Customer Continuance Intention	30.7975	5.56173	33.5122	5.34847	-2.569	0.011*

Source: Computed from Primary data

Note:

1. Denotes significant at 1% level**

2. * Denotes significant at 5% level

Null Hypothesis (H₀):

There is no significant difference between married and unmarried respondents regarding Digital Signature, AI-Based Fraud Prevention, Security Confidence, and Customer Continuance Retention.

The independent samples t-test was conducted to examine whether there were significant differences between married and unmarried respondents. Table-3 present the results indicate that all four variables have p-values less than 0.05, showing statistically significant differences between the two groups. Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted for all variables.

Table – 4: ANOVA for significant difference among net Banking experience with factors of AI integration in net banking Security

Factors of AI Integration in Net banking Security	Net Banking Experience				F– value	P– value
	Less than 1 Year	1-3 Years	4-6 Years	Above 6 Years		
Digital Signature Authentication	31.5581 (5.68332)	31.2222 (4.94924)	35.6667 (3.12250)	34.7391 (4.03640)	4.236	0.0071
AI-Based Fraud Prevention	30.3488 (5.41991)	30.3556 (4.49826)	31.2222 (3.86580)	32.9130 (4.35799)	1.751	0.160
Security Confidence	29.9767 (5.67152)	30.7111 (4.87397)	31.2222 (3.92994)	33.7826 (5.77578)	2.693	0.049
Customer Continuance Intention	30.5349 (6.43409)	31.2889 (4.82711)	32.3333 (4.84768)	34.5652 (4.98020)	2.856	0.040

Source: Computed from Primary data

Note:

1. The value within bracket refers to SD.
2. Denotes significance level 5%

Null Hypothesis (H₀):

There is no significant difference among net Banking experience with factors of AI integration in net banking Security.

Table 4 presents the results of the One-Way ANOVA analysis. The findings show that Digital Signature ($F = 4.236$, $p = 0.007$), Security Confidence ($F = 2.693$, $p = 0.049$), and Customer Continuance Retention ($F = 2.856$, $p = 0.040$) exhibit statistically significant differences among the groups, as their p-values are less than 0.05. However, AI-Based Fraud Prevention ($F = 1.751$, $p = 0.160$) does not show a statistically significant difference since the p-value is greater than 0.05. Hence, the null hypothesis is rejected for Digital Signature, Security Confidence, and Customer Continuance Retention, while it is accepted for AI-Based Fraud Prevention.

Chi-Square Test**Table – 5: Level of Net Banking Experience with respect to Age group in years**

Age Group in years	Level of Net Banking Experience				Total	Chi - Square value	P- value
	Less than 1 Year	1-3 Years	4-6 Years	Above 6 Years			
Below 25 Years	31	30	5	2	68	35.951	.000
25 – 35 Years	7	10	3	13	33		
36 – 45 Years	3	4	0	5	12		
46-55 Years	2	1	1	1	5		
Above 55 Years	0	0	0	2	2		
Total	43	45	9	23	120		

Source: Computed from Primary data

Null Hypothesis (H₀): There is no significant association between age group and the level of net banking experience among bank customers.

Interpretation: The Chi-Square test results show a significant association between age group and the level of net banking experience ($\chi^2 = 35.951$, $df = 12$, $p < 0.001$). Since the p-value is less than 0.05, the null hypothesis is rejected and the alternative hypothesis is accepted. This indicates that net banking experience differs significantly across different age groups. The Symmetric Measures indicate a moderate association between the variables (Cramer's V = 0.316, $p < 0.001$). This shows that the relationship is statistically significant and of moderate strength.

Correlation Analysis

Table – 6: Pearson's Correlation Coefficient Between Factors of AI-Based Net Banking Security

Factors of AI-Based Net Banking Security	Mean	Std. Deviation	Digital Signature Authentication	AI-Based fraud Prevention	Security Confidence	Customer Continuance Intention
Digital Signature Authentication	32.3500	5.17371	1	0.691**	0.707**	0.641**
AI-Based fraud Prevention	30.9083	4.83509	-	1	0.754**	0.682**
Security Confidence	31.0750	5.40800	-	-	1	0.809**
Customer Continuance Intention	31.7250	5.61804	-	-	-	1

Source: Computed from Primary data

Note:

**** Denotes significant at 1% level**

The above table-6 shows that Pearson correlation analysis indicates that all the study variables are positively and significantly correlated at the 1% significance level ($p < 0.01$). Among the variables, Security Confidence has the strongest positive relationship with Customer Continuance Retention ($r = 0.809$), followed by AI-Based Fraud Prevention ($r =$

0.682) and Digital Signature Authentication ($r = 0.641$). The findings suggest that improvements in digital signature authentication, AI-based fraud prevention, and security confidence are associated with higher customer continuance retention. Therefore, the null hypothesis is rejected, and the alternative hypothesis is accepted.

Findings

Based on the demographic profile of the respondents major findings are:

- The majority of the respondents are below 25 years of age.
- Most of the respondents are undergraduates.
- The majority of the respondents are employed in the private sector.
- Majority of the respondents have a monthly income below Rs. 25,000.
- The majority of the respondents are unmarried.
- Most of the respondents belong to nuclear families.

The study found that most respondents were aware of digital signature authentication and regularly used AI-based net banking services.

Suggestions

- Banks should strengthen digital signature authentication by adopting advanced AI-based security systems.
- Regular awareness programmes should be conducted to educate customers about safe net banking practices.
- Banks should provide timely alerts and continuous monitoring to prevent fraudulent transactions.
- Customers should be encouraged to update passwords and use multi-factor authentication.
- Financial institutions should improve cybersecurity measures through regular system updates and security audits.
- Government and regulatory authorities should establish stronger policies to enhance the safety and reliability of digital banking services.

Conclusion

The study concludes that digital signature authentication is an effective tool for improving the security of AI-based net banking. It plays a significant role in preventing online

fraud and protecting customer information. The findings indicate that secure authentication systems increase customer trust and confidence in digital banking services. The use of AI further strengthens fraud detection and transaction security. Banks should continue to adopt advanced security technologies and create customer awareness. Overall, digital signature authentication contributes to safe, reliable, and efficient net banking services.

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Industry 5.0 Adoption and Its Impact on The Operational Performance of MSMEs in Thoothukudi District

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Abstract

Industry 5.0 represents the next phase of industrial transformation by integrating advanced technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), collaborative robots, big data analytics, and automation with human creativity and decision-making. Unlike industry 4.0, Industry 5.0 emphasizes human-centric, sustainable, and resilient manufacturing system. For MSMEs, adopting Industry 5.0 technologies has the potential to improve operation performance by enhancing productivity, product quality, resource utilization, operational flexibility, and customer satisfaction while promoting employee well-being. Thoothukudi district, being one of Tamil Nadu's major industrial hubs with MSMEs engaged in sectors such as seafood processing, salt production, chemicals, Agri-based industries, engineering and food processing, offers an appropriate setting to examine the adoption of Industry 5.0 practices. The present study aims to assess the extent of Industry 5.0 adoption among MSMEs in Thoothukudi district and analyze its impact on their operational performance. The study focuses on key dimensions of Industry 5.0 adoption, including digital technologies, human-machine collaborations, sustainable manufacturing practices, workforce skill development, and organizational innovation. Primary Data will be collected from employees of selected MSMEs using a structured questionnaire. Statistical techniques such as percentage analysis, Chi-Square test, Correlation and regression analysis, and ANOVA will be employed to examine the relationship between Industry 5.0 adoption and operational performance indicators. The finding of the study is expected to provide valuable insights into the level of Industry 5.0 readiness among MSMEs and identify the factors influencing successful implementation. The study will also offer practical recommendations to MSME owners, policymakers, and government agencies for promoting technology adoption,

improving operational efficiency, and strengthening the competitiveness and sustainability of MSMEs in thoothukudi district. Furthermore, the research is expected to contribute to the existing body of knowledge on Industry 5.0 by providing empirical evidence from the Indian MSME context.

Keywords: *Industry 5.0 Adoption, Operational Performance, Artificial Intelligence, Sustainable Manufacturing*

Introduction

MSMEs play a vital role in India's economic growth by generation employment, promoting entrepreneurship, and contributing to industrial and regional development. Thoothukudi district is home to a wide range of MSMEs, including seafood processing, salt manufacturing, chemicals, engineering, Agri-based, and food processing industries. Industry 5.0 represents the next stage of industrial development by integrating advanced technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), collaborative robots, and data analytics with human creativity and decision-making. Unlike Industry 4.0, Industry 5.0 emphasizes human-centricity, sustainability, and resilience to improve both employees' well-being and organizational performance. The adoption of Industry 5.0 technologies can help MSMEs enhance productivity, product quality, operational efficiency, innovation and customer satisfaction while reducing costs and supporting sustainable business practices. However, many MSMEs face challenges such as limited financial resources, inadequate technological infrastructure, skill gaps, and resistance to technological change. The study aims to examine the level of Industry 5.0 adoption and its impact on the operational performance of MSMEs in thoothukudi district. The findings are expected to help MSME owners, policymakers, and government agencies develop effective strategies to improve technology adoption, operational efficiency and sustainable industrial growth.

Objectives of the Study

- ✓ To examine the level of Industry 5.0 adoption among MSMEs in Thoothukudi district.
- ✓ To identify the key factors influencing the adoption of Industry 5.0 technologies in MSMEs.
- ✓ To assess the impact of Industry 5.0 adoption on the operational performance of MSMEs in thoothukudi district.

- ✓ To analyse the relationship between industry 5.0 adoption and operational performance indicators such as productivity, quality, efficiency, flexibility and customer satisfaction.
- ✓ To suggest suitable strategies and policy recommendations for enhancing industry 5.0 adoption and improving the operational performance of MSMEs in thoothukudi district.

Statement of Problem

MSMEs play a crucial role in the economic development of India by generating employment, promoting entrepreneurship and contributing to industrial growth. In Thoothukudi district, MSMEs are engaged in various sectors such as seafood processing, salt manufacturing, chemicals, engineering, Agri-based industries, and food processing. However, increasing global competition, rapid technological advancement, and changing customer expectations have created significant operational challenges for these enterprises. Industry 5.0 has emerged as a new industrial paradigm that combines advanced technologies such as AI, the Internet of Things (IoT), collaborative robots, and data analytics with human creativity, sustainability, and resilience. Although these technologies have the potential to improve productivity, operational efficiency, product quality, and innovation, many MSMEs face difficulties in adopting them due to limited financial resources, inadequate technological infrastructure, shortage of skilled workforce, lack of awareness, and resistance to organizational change. Therefore, this study seeks to examine the adoption of Industry 5.0 and its impact on the operational performance of MSMEs in Thoothukudi district. The findings will help MSME owners, managers, and policymakers formulate effective strategies to accelerate industry 5.0 adoption, enhance operational performance, and ensure the long-term sustainability and competitiveness of MSMEs.

Scope of the Study

The present study focuses on the adoption of Industry 5.0 and its impact on the operational performance of MSMEs in Thoothukudi district, Tamil Nadu. It examines the extent to which Industry 5.0 technologies, such as AI, the Internet of Things (IoT), collaborative robots, cloud computing, and data analytics, are adopted by MSMEs and how these technologies influence operational performance. The study covers MSMEs operating in major sectors of Thoothukudi district, including seafood processing, salt manufacturing, chemicals, engineering, Agri-based, and food processing industries. It evaluates key dimensions of operational performance, such as productivity, product quality, operational

efficiency, cost reduction, flexibility, innovation, and customer satisfaction. The research also identifies the factors influencing Industry 5.0 adoption, including technological readiness, organizational support, employee skills, financial capability, and awareness of advanced technologies. In addition, it examines the challenges faced by MSMEs in implementing Industry 5.0 practices and suggests suitable strategies to overcome these barriers. The findings of the study are expected to benefit MSME owners, managers, policymakers, government agencies, and researchers by providing practical insights for improving technology adoption, enhancing operational performance, and promoting sustainable industrial development in Thoothukudi district. Furthermore, the study contributes to the existing literature on Industry 5.0 by providing empirical evidence from the MSME sector in a developing economy.

Research Methodology

Research Design: Descriptive and Analytical Research Design.

Nature of the Study: Quantitative Research

Study Area: Thoothukudi, Tamil Nadu.

Population of the Study: Employees working in selected MSMEs in Thoothukudi district.

Sampling Techniques: Non-Probability Judgemental Sampling.

Sample Size: As determined by the selected sampling methods (mention the actual sample size used in the study).

Sources of Data

- ✓ **Primary Data:** Structured questionnaire administered to MSME employees.
- ✓ **Secondary Data:** Books, Journals. Research articles, Government reports, MSME publications. Websites, and official records.

Statistical Tools Used

- ✓ Percentage Analysis
- ✓ Chi-Square Test
- ✓ Correlation Analysis
- ✓ Regression Analysis
- ✓ ANOVA

Data Analysis and Interpretation

Table – 1: Percentage Analysis – Level of Industry 5.0 Adoption

Level of Adoption	Frequency	Percentage
Low	45	18%
Moderate	138	55.2%
High	67	26.8%
Total	250	100%

Sources: (Primary Data)

Interpretation

The results reveal that 55.2% of the respondents perceive that their MSMEs have a moderate level of Industry 5.0 adoption, while 26.8% report a high level and 18% report a low level. This indicates that most MSMEs are in the transition phase towards Industry 5.0 implementation.

Chi – Square Test

Hypothesis:

H_0 = There is a no significant association between gender and industry 5.0 adoption.

H_1 = There is a significant association between gender and industry 5.0 adoption

Table – 2: Gender and Industry 5.0 Adoption

Chi-Square Value	df	p-value	Result
7.286	2	0.026	Significant

Interpretation

Since the p-value (0.026) is less than 0.05, the null hypothesis is rejected. Therefore, there is a significant association between gender and the perception of Industry 5.0 adoption among MSME employees.

Table – 3: Correlation Between Industry 5.0 Adoption and Operational Performance

Variables	Correlation (r)	p-value
Industry 5.0 Adoption & Operational Performance	0.742	0.000

Interpretation

The Correlation Coefficient ($r=0.742$) indicates a strong positive relationship between Industry 5.0 adoption and operational performance. Since the p-value is less than 0.01, the relationship is statistically significant.

Regression Analysis

Table – 4 Dependent Variables: Operational Performance

Variables	beta	t-value	p-value
Industry 5.0 adoption	0.698	14.532	0.000

Model Summary	Value
R	0.742
R ²	0.551
Adjusted R ²	0.547
F-value	211.18
Significant	0.000

Interpretation

The Regression Analysis shows that Industry 5.0 adoption has a significant positive impact on operational performance ($\beta = 0.698$, $p < 0.001$). The R² value of 0.551 indicates that 55.1% of the variation in operational performance is explained by Industry 5.0 adoption. The model is statistically significant, confirming that greater adoption of Industry 5.0 practices contributes to improved operational performance among MSMEs in Thoothukudi district.

Findings of the Study

- ✓ The study found that the majority of MSMEs in Thoothukudi district have a moderate level of Industry 5.0 adoption, indicating that many enterprises have begun implementing advanced digital technologies but have not yet achieve full integration.
- ✓ The study revealed a significant positive relationship between Industry 5.0 adoption and operational performance, MSMEs adopting Industry 5.0 practices reported improvements in productivity, product quality, operational efficiency, and customer satisfaction.

- ✓ The regression analysis indicated that Industry 5.0 adoption significantly influences operational performance, demonstrating that greater adoption leads to better business outcomes.
- ✓ The study identified major challenges to Industry 5.0 adoption, including limited financial resources, inadequate technological infrastructure, lack of skilled employees and insufficient awareness of advanced technologies.

Suggestion of the Study

- ✓ MSMEs should invest in Industry 5.0 technologies such as AI, the Internet of Things (IoT), cloud computing, and data analytics to improve productivity and operational efficiency.
- ✓ Government agencies should provide financial assistance, subsidies, tax incentives, and low-interest loans to encourage MSMEs to adopt industry 5.0 technologies.
- ✓ Regular training and skill development programmes should be organized to enhance employees' digital competencies and improve human-machine collaborations.
- ✓ MSMEs should strengthen their digital infrastructure and cybersecurity measures to ensure the secure and effective implementation of Industry 5.0 technologies.
- ✓ Collaboration among MSMEs, educational institutions, research organizations, and technology providers should be encouraged to promote innovations, knowledge sharing, and sustainable industrial development.

Conclusions

Industry 5.0 technologies the future of manufacturing by integrating advanced technologies with human creativity, sustainability, and resilience. The findings of the study indicate that the adoption of Industry 5.0 has a positive and significant impact on the operational performance of MSMEs in Thoothukudi district. Enterprise that effectively implement Industry 5.0 technologies achieve higher productivity, improved product quality, greater operational efficiency, and enhanced customer satisfaction. However, challenges such as financial constraints, technological limitations, and skill shortages continue to hinder widespread adoption. Therefore, coordinated efforts from MSME owners, government agencies, and educational institutions are essential to promote Industry 5.0 implementations. By embracing Industry 5.0, MSMEs can enhance their competitiveness, achieve sustainable growth, and contribute significantly to the economic development of thoothukudi district and India.

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A Study on The Role of Human Resource Management Practices in Enhancing Work – Life Integration Among Faculty Members in Higher Educational Institutions in Tirunelveli District

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Abstract

Human Resource Management (HRM) plays a significant role in enhancing employee well-being, productivity, and organizational effectiveness. In higher educational institutions, faculty members are expected to balance teaching, research, administrative responsibilities, and personal commitments simultaneously. The concept of Work-Life Integration (WLI) has emerged as an important factor influencing faculty performance, job satisfaction, and organizational commitment. This study examines the role of Human Resource Management practices in enhancing Work-Life Integration among faculty members in Higher Educational Institutions in Tirunelveli District. The study adopts a descriptive research design and utilizes primary data collected from faculty members working in arts and science colleges, engineering colleges, and universities. Statistical tools such as Percentage Analysis, proposed for data analysis. The findings are expected to reveal that effective HRM practices such as training and development, performance appraisal, employee welfare measures, flexible work arrangements, and supportive organizational culture positively influence Work-Life Integration among faculty members. The study provides practical recommendations for educational administrators to formulate effective HR policies that promote faculty well-being and institutional effectiveness. Research in higher education consistently shows that HRM practices, employee welfare initiatives, and supportive work environments improve faculty engagement, satisfaction, and performance.

Keywords: *Human Resource Management, Work-Life Integration, Faculty Members, Higher Educational Institutions, Job Satisfaction, Tirunelveli District*

Introduction

Higher Educational Institutions (HEIs) are knowledge-based organizations where faculty members play a crucial role in achieving academic excellence. In recent years, faculty members have been experiencing increased workloads due to teaching responsibilities, research activities, accreditation requirements, administrative tasks, and student mentoring. These responsibilities often blur the boundaries between personal and professional life.

Work-Life Integration refers to the effective management of professional and personal responsibilities in a way that allows individuals to achieve satisfaction and effectiveness in both domains. Unlike traditional Work-Life Balance, Work-Life Integration emphasizes the harmonious blending of work and personal life responsibilities.

Human Resource Management practices significantly contribute to creating a supportive environment that enables faculty members to integrate their professional and personal lives effectively. HRM practices such as flexible work schedules, employee wellness programs, training opportunities, fair performance appraisal systems, and supportive leadership enhance employee well-being and performance. Studies in higher education indicate that HRM practices positively affect faculty satisfaction, engagement, and performance outcomes.

Statement of the Problem

Faculty members in Higher Educational Institutions face increasing professional demands arising from teaching, research, accreditation activities, and administrative responsibilities. These demands often create challenges in integrating work and personal life effectively. Although HRM practices are intended to support employee well-being, there is limited empirical evidence regarding their effectiveness in enhancing Work-Life Integration among faculty members in Tirunelveli District. Therefore, this study seeks to examine the role of HRM practices in improving Work-Life Integration among faculty members.

Objectives of the Study

- To examine the HRM practices followed in Higher Educational Institutions in Tirunelveli District.
- To assess the level of Work-Life Integration among faculty members.

- To analyze the relationship between HRM practices and Work-Life Integration.
- To examine the impact of Work-Life Integration on faculty performance.
- To suggest measures for improving Work-Life Integration through HRM practices.

Research Methodology

Research Design: Descriptive Research Design

Area of Study: Tirunelveli District

Population: Faculty members working in Higher Educational Institutions

Sampling Technique: Stratified Random Sampling

Sample Size: 200 Faculty Members

Sources of Data:• Primary Data – Structured Questionnaire• Secondary Data – Journals, Books, Reports, Websites

Tools for Analysis:• Percentage Analysis

Percentage Analysis

Sample Size: 200 Faculty Members

Table 1: Training and Development Programs Improve Teaching Effectiveness

Response	Frequency	Percentage (%)
Strongly Disagree	8	4.0
Disagree	16	8.0
Neutral	30	15.0
Agree	88	44.0
Strongly Agree	58	29.0
Total	200	100.0

Interpretation

The table reveals that 73.0% of the respondents agree that training and development programs improve their teaching effectiveness, while only 12.0% disagree.

Table 2: Institution Supports Work-Life Integration

Response	Frequency	Percentage (%)
Strongly Disagree	10	5.0
Disagree	18	9.0
Neutral	34	17.0
Agree	84	42.0
Strongly Agree	54	27.0
Total	200	100.0

Interpretation

The majority of respondents (69.0%) agree that their institution supports Work-Life Integration, whereas only 14.0% express disagreement.

Table 3: Flexible Work Arrangements Help Balance Responsibilities

Response	Frequency	Percentage (%)
Strongly Disagree	12	6.0
Disagree	20	10.0
Neutral	28	14.0
Agree	86	43.0
Strongly Agree	54	27.0
Total	200	100.0

Interpretation

About 70.0% of the faculty members agree that flexible work arrangements help them balance their professional and personal responsibilities effectively.

Table 4: Work-Life Integration Improves Faculty Performance

Response	Frequency	Percentage (%)
Strongly Disagree	6	3.0
Disagree	14	7.0

Neutral	24	12.0
Agree	96	48.0
Strongly Agree	60	30.0
Total	200	100.0

Interpretation

A significant majority (78.0%) of respondents agree that Work-Life Integration improves their teaching performance and overall productivity.

Findings

- Most faculty members believe that training and development programs enhance their teaching effectiveness.
- Higher Educational Institutions in Tirunelveli District provide reasonable support for Work-Life Integration.
- Flexible work arrangements play a vital role in balancing personal and professional responsibilities.
- Effective Work-Life Integration contributes positively to faculty performance and job satisfaction.

Suggestions

- Higher Educational Institutions should conduct regular training and faculty development programs to enhance professional competencies.
- Institutions should introduce flexible work policies and supportive work environments to strengthen Work-Life Integration.
- Employee wellness programs, counseling services, and stress management workshops should be organized periodically.
- Management should reduce excessive administrative workload and encourage a healthy work culture.
- Institutions should formulate HR policies that promote employee well-being and work flexibility.

Conclusion

Work-Life Integration has become an essential factor in improving faculty well-being and institutional effectiveness. The percentage analysis indicates that Human Resource Management practices such as training and development, institutional support, and flexible work arrangements significantly contribute to effective Work-Life Integration among faculty members. Improved Work-Life Integration enhances faculty performance, job satisfaction, and organizational commitment. Therefore, Higher Educational Institutions in Tirunelveli District should strengthen HRM practices to create a supportive and sustainable work environment for faculty members

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The Impact of Artificial Intelligence on Postgraduate Students in Arts and Science Colleges in Chennai District

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Abstract

In the modern technology world, nowadays artificial intelligence plays a significant role in various aspects of life. Artificial Intelligence is one the most transformative technologies of the era students should be trained on its correct usage. AI is poised to transform the education ecosystem and reshape the landscape of future employment both globally and within the state. A lot of research has been done in the impact of artificial intelligence on college postgraduate students. The impact of artificial intelligence on Arts and Science colleges' postgraduate students refers to the student's educational environment. Artificial Intelligence tools can also enhance student's engagement and provide valuable support for various learning styles. The research paper focuses on the impact of artificial intelligence on postgraduate students in arts and science colleges such as artificial intelligent knowledge and skill, subject learning, language learning, grammar check, data analysis, entertainment. The research paper included secondary data collected from different sources such as journals, books, magazines etc. The research study gives a comprehensive understanding of the impact of artificial intelligence on postgraduate students in Arts and Science colleges in Chennai district.

Keywords: Artificial Intelligence Technology, Student Information, Generating New Idea and Decision Making

I. Introduction

Artificial Intelligence has become increasingly important in the modern world. Artificial Intelligence continues to shape the future of education. The use of artificial intelligence in education has been a major disruptor in the sector. It has transformed the

traditional classroom model, introducing technological advancements to assist remote learning, such as automated tutoring support and adaptive learning platforms. One of the most significant advantages of artificial intelligence in education is the ability to create personalized learning experiences. The impact of artificial intelligence on education is profound and several future benefits for students are becoming increasingly apparent. Artificial Intelligence is not just a tool but a transformative force in education. Artificial Intelligence is poised to revolutionize the Indian education system by providing personalized learning experiences, improving access to quality education and enhancing teaching methods. Artificial Intelligence can transform education in India, making it more inclusive, efficient, and effective.

II. Review of Literature

The reviewed literature indicates that AI has become an important educational tool that enhances subject learning, language development and academic performance. However, researchers consistently emphasize the need for ethical use, AI literacy and guidance from educational institutions to maximize its benefits.

Dr. Sandip Majumdar (2022) in his research work entitled “**AI in Indian Education: Enhancing Learning and Teaching in the Digital Age**” the research study aims at AI is poised to revolutionize the Indian education system by providing personalized learning experiences, improving access to quality education, and enhancing teaching methods. While there are significant challenges to overcome, the potential benefits far outweigh the obstacles. With the right infrastructure, policies, and investment, AI can transform education in India, making it more inclusive, efficient, and effective¹.

Rajiv Gupta (2023) in his research work entitled “**Research Paper on Artificial Intelligence**” the research study aims at this branch of computer science is concerned with making computers behave like humans. Artificial intelligence includes game playing, expert systems, neural networks, natural language, and robotics. Currently, no computers exhibit full artificial intelligence (that is, are able to simulate human behavior). The greatest advances

¹**Dr. Sandip Majumdar**, AI in Indian Education, Enhancing Learning and Teaching in the Digital Age, *Journal of Emerging Technologies and innovative research (JETIR)*, 2022, Volume 9, Issue 10, September, pp. 125, www.jetir.org (ISSN-2349-5162).

have occurred in the field of games playing. The best computer chess programs are now capable of beating humans. Today, the hottest area of artificial intelligence is neural networks, which are proving successful in a number of disciplines such as voice recognition and natural-language processing. There are several programming languages that are known as AI languages because they are used almost exclusively for AI applications.²

Anjali Kumari (2026) in her research work entitled **“Impact of Artificial Intelligence on Student Education and Career Development”** the study aims at the lack of a human touch, data privacy concerns, ethical concerns with AI in education, and the expense of creating AI systems were the main obstacles we covered. All things considered, we can say that artificial intelligence is transforming education and bringing about significant improvements, but there are also some issues that must be resolved before any true progress can be achieved. Prospects for the Future AI-based systems, like ChatGPT and other such AI-related tools, will be crucial to education in the future. As a result, future studies can concentrate more intently on ChatGPT's educational function³.

Shamsiah Manu mohamed hanefare Et al., (2026) in their research work entitled **“Artificial Intelligence in Education: A Systematic Review of Personalized Learning Trends and Future Directions”** focus on the progress and deficiencies in the integration of artificial intelligence and personalized learning in education. It underscores a transition in global research priorities from dominant regions such as China, USA and Europe to broader Asia, signaling new opportunities for educational improvement. However, the findings reveal that the swift expansion of AI, combined with persistent concerns about educational standards in developing countries, may create additional institutional pressures that influence the effectiveness of education⁴.

²**Rajiv Gupta**, Research paper on Artificial Intelligence , **Journal of Emerging Technologies and innovative research (JETIR)**,2022, Volume 9, Issue 10, September, pp. 125, www.jetir.org (ISSN-2349-5162).

³**Anjali Kumari**, Impact of Artificial Intelligence on Student Education and Career Development, International Journal of Scientific Development and Research (IJS DR), ISSN:2455-2631 February 2026 IJS DR | Volume 11 Issue 2 IJS DR2602093 www.ijsdr.org PP745 – 749.

⁴ **Shamsiah Manu mohamed hanefare Et al.**, ‘Artificial intelligence in education: a systematic review of personalized learning trends and future directions’, Front. Educ., 13 March 2026, Sec. Digital Education, Volume 11 - 2026 | <https://doi.org/10.3389/educ.2026.1782626>..

III. Objectives

The rapid growth of Artificial Intelligence has significantly influenced the education sector by providing students with innovative learning tools and personalised educational support. Students increasingly use AI for subject learning language development grammar checking, research academic writing. Therefore, this research study aims to examine students' use of AI and its impact on their learning experience through the following objectives.

1. To determine the impact of different male or female postgraduate students (group) has a higher usage of Artificial Intelligence in academics.
2. To analyses the impact of different in which degree course is Artificial Intelligence used most extensively by postgraduate students.
3. To investigate the impact of the reasons for using of Artificial Intelligence by postgraduate students.

IV. Research Methodology

The research conducted is based on descriptive analysis research design. Primary data was collected using closed ended questionnaires through Google forms. The random sampling technique is used and the sample size of this research is 200 respondents. All the respondents of this research are postgraduate students. Secondary data has also been collected from various journals, websites and newspaper reports.

V. The Students Behaviour of Artificial Intelligence (Data Analysis & Interpretation)

The integration of Artificial Intelligence in education has transformed academic learning and influence both opportunities and challenges for students' development. The research identified under the three heads (i) Male and Female Students has a Higher Usage, (ii) In Which Degree Course is Artificial Intelligence used Most Extensively by Students (iii) Reasons for Artificial Intelligence Usage as discussed details below.

V.1. Male or Female Postgraduate Students (Group) Has A Higher Usage of Artificial Intelligence in Academics

Artificial Intelligence is used in a wide range of application from everyday tasks like using digital assistants. While Artificial Intelligence itself doesn't have a gender and societal perceptions, biases can influence how Artificial Intelligence is used and perceived by different genders. The research study identified the student groups under two the heads,

namely, (i) male and (ii) female. The scrutiny of the data disclosed that out of 200 students, a majority of 123 students, representing 61.50 per cent, were male and the remaining 77 students (38.50 per cent) were female. Table 1 revealed the female or male students (group) has a higher usage of artificial intelligence in academics.

Table 1: Male or Female the Students (Group) has a Higher Usage of Artificial Intelligence in Academics

S. No.	Student Groups	Number of Students	Percentage to total
1.	Male Students	123	61.50
2.	Female Students	77	38.50
	Total	200	100.00

Source: Primary Data

It is lucid from the Table 3.1 that a majority of 61.50 per cent of Artificial Intelligence in academics in Chennai district are 'Male Students'.

V.2. In Which Degree Course is Artificial Intelligence used most Extensively by Postgraduate Students

The students pursuing degree courses can substantial benefit from integrating artificial intelligence tools and skills into their studies and future career. Artificial intelligence applications are becoming increasing valuable for graduates. In which degree course is artificial intelligence used most extensively by students. Hence the research identified ten types of degree course namely. (i) M.Com., (ii) M.B.A., (iii) M.C.A., (iv) M.Sc.(Computer Science), (v) M.Sc.,(Mathematics), (vi) M.Sc.,(Physics), (vii) M.Sc.,(Chemistry), (viii) M.A.,(English), (ix)M.A.,(Tamil), (x) M.A., (History) as discussed below Table 2.

Table 2: In which degree course is Artificial Intelligence used most extensively by the students

S. No.	Degree Course	Very Low	Low	Normal	High	Very High	Total Points	Mean Scores
1.	M.Com.	14	45	34	45	62	200	3.48
		14	90	102	180	310	696	

2.	M.B.A.	50	21	19	45	65	200	3.27
		50	42	57	180	325	654	
3.	M.C.A.	9	13	13	55	110	200	4.22
		9	26	39	220	550	844	
4.	M.Sc. (Computer Science)	5	4	6	31	154	200	4.63
		5	8	18	124	770	925	
5.	M.Sc. (Mathematics)	27	54	31	45	43	200	3.12
		27	108	93	180	215	623	
6.	M.Sc. (Physics)	44	34	26	40	56	200	3.15
		44	68	78	160	280	630	
7.	M.Sc. (Chemistry)	32	43	31	32	62	200	3.25
		32	86	93	128	310	649	
8.	M.A. (English)	23	12	45	44	76	200	3.69
		23	24	135	176	380	738	
9.	M.A. (Tamil)	24	12	98	44	12	190	3.04
		24	24	294	176	60	578	
10.	M.A.(History)	38	12	96	44	10	200	2.88
		38	24	288	176	50	576	

Source: Primary Data.

The highlight of the Table 2 is that the three major degree course ‘M.Sc.,(Computer Science)’(4.63 scores), M.C.A., (4.22 Scores) and M.A.(English)(3.69 scores) are Artificial Intelligence used most extensively by Arts and Science Colleges Postgraduate Students in Chennai District.

V.3. Reasons for Artificial Intelligence Usage

Artificial Intelligence offers several benefits for students. Artificial Intelligence also encourages students to develop critical thinking skills and knowledge they need for continuous learning and career development. The research study identified the various reasons of using artificial intelligence by Arts and Science colleges postgraduate students in Chennai district under the five heads, namely (i) subject learning (ii) language learning, (iii) grammar check, (iv) data analysis and (v) entertainment. During the survey, the students were

asked to mention the specific reasons for artificial intelligence usage. The Table 3 contains the findings of the study on reasons for using of artificial intelligence.

Table 3: Reasons for Artificial Intelligent Usage

S. No	Reasons	Number of Students					Total Points	Mean Scores	Rank
		1	2	3	4	5			
1.	Subject Learning	4	10	6	40	140	200	4.51	I
		4	20	18	160	700	902		
2.	Language Learning	8	30	22	50	90	200	3.92	II
		8	60	66	200	450	784		
3.	Grammar Check	25	46	24	40	65	200	3.37	III
		25	92	72	160	325	674		
4.	Data Analysis	45	39	22	34	60	200	3.13	IV
		45	78	66	136	300	625		
5.	Entertainment	104	10	23	30	33	200	2.39	V
		104	20	69	120	165	478		

Source: Primary data.

The Table 3 highlights that the important reasons for artificial intelligence usage are ‘subject learning’ is ranked the first (4.51 Scores), ‘language learning’ is ranked the second (3.92 Scores) and ‘grammar check’ is ranked the third (3.37 Scores).

VI. Suggestions

AI based tools should be integrated into teaching and learning activities to enhance student engagement. The college students should use AI to improve language skills and grammar while also developing their own writing and critical thinking abilities. The college students should be encouraged to verify AI – generated information using reliable academic sources. ***Future research should be conducted with larger samples and different educational institutions to better understand students’ AI usage and its impact on learning outcomes.*** The college students should verify AI generated information with reliable academic sources before using it for academic purposes.

VII. Conclusion

Artificial Intelligence (AI) has become an important part of higher education and is changing the way college students learn. ***The research study concludes that male students use Artificial Intelligence (AI) tools more frequently than female students. Among the different postgraduate programmes M.Sc., (Computer Science) students are the highest users of Artificial Intelligence (AI), followed by MCA students rank second while M.A., (English) students rank third in their use of AI and the postgraduate students mainly use AI for subject learning, followed by language learning and grammar checking.*** This suggests that AI has become an important educational tool that supports academic performance and communication skills. Educational Institutions should encourage the responsible and effective use of AI to maximize its benefits while promoting independent learning and critical thinking. The results highlight the growing importance of AI in higher education and indicate the need to encourage its effective and responsible use across all degree programmes appropriate training and institutional support.

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An Analysis of Millennials and Generation Z in Chennai to Determine the Impact of AI-Powered Social Media Marketing on Fashion Purchase Behavior

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Abstract

Goal

This research will seek to comprehend social media's impact on marketing using AI on the purchase of fashion goods among Millennials and Generation Z in Chennai. The specific study's goal is to compare the traits and behaviours of the two generations as influenced by personalization through AI, influencer marketing, user-generated content, brand authenticity and social media engagement.

Design/Methodology

For this study, a quantitative research methodology was employed, Descriptive and Comparative. A structured questionnaire was used for data collection, which consisted of a five-point Likert Scale. 400 respondents (200 Millennials and 200 Generation Z customers) from Chennai city were included in the survey. Factor analysis, correlation analysis, hand-square test, and structural equation modeling (SEM) were used to analyze the collected data.

Findings

The results indicated that artificial intelligence-based social media marketing had a substantial influence on consumer engagement and fashion purchase behavior. Social media engagement and artificial intelligence personalization were established as the top predictors of consumer engagement, and consumer engagement had a positive effect on fashion purchase behavior. The research further identified some differences in the behavior of Millennials and Generation Z, where Generation Z responded positively to AI-based marketing efforts and influencer marketing.

Originality

By combining AI personalization, Social Media Engagement, User-Generated Content (UGC), Affiliate Marketing, and Broad Authenticity, consumer engagement, and fashion purchasing behavior into a single conceptual framework, the current study advances our understanding. The research also includes a comparative analysis of Millennials and Gen Z employing Structural Equation Modelling (SEM) within the domain of the fashion retail industry in Chennai.

Keywords: *Artificial Intelligence, Social Media Marketing, Fashion Purchase Behavior, Consumer Engagement, Millennials, Generation Z, AI Personalization, Influencer Marketing, Structural Equation Modeling (SEM)*

I. Introduction

Artificial Intelligence (AI) technology has revolutionized digital marketing in a major way by making personalized, data-driven, and interactive experience of customers possible for businesses. In the fashion retail sector, AI-powered social media marketing has become vital as it not only helps in boosting consumer engagement and building strong brand relations but also affects consumers' purchasing decisions. Platforms like Instagram, Facebook, YouTube, and Tiktok make use of AI technology that tailors the content and recommends and advertises products based on the user's browsing behavior and preferences.

The explosive rise of social commerce has led to increased application of AI in fashion marketing. Personalized product recommendation, predictive analytics, chatbot technology, virtual try-on applications, and influencer analytics allow fashion retailers to offer customized shopping experience and increase customer satisfaction. Since people increasingly use digital channels to find fashion ideas and make purchases, AI marketing has become a primary factor shaping the consumers' behavior.

Behavior of customers in the fashion industry is affected by such factors as social media activities, influencer promotions, user-generated content, and personalized marketing campaigns. Instead of focusing merely on traditional promotional efforts, modern consumers actively search for relevant information, peer reviews, and interesting digital experiences before purchasing anything. This can be enhanced by using AI technology, which analyzes the consumers' preferences and delivers relevant content.

Millennials and Generation Z are two important market segments, the customers of which have significant purchasing power. Even though they both are heavy social media users, the approaches towards technology, brands, and shopping are different. While Millennials value product information, reliable brands, and personalized communication, Generation Z customers are highly engaged in influencer marketing, short-form video content, interactive experiences, and AI personalization.

There have been tremendous developments in internet penetration, smartphone adoption, and social media usage in India, which has made digital marketing a necessary element in the retail industry. Being one of the major metropolitan cities in India, Chennai consists of consumers that are technologically inclined and fashion conscious, and thus is an apt environment to study differences across generations in AI-enabled social media marketing. Fashion brands in Chennai are increasingly relying on AI to deliver personalized experience and enhance engagement.

However, despite increased use of AI in marketing efforts, studies that Compare how AI marketing affects Millennials' and Generation Z's fashion purchasing habits in the Indian context are relatively few. Previous research has been mostly focused on individual elements of social media marketing or on a particular generation only, and thus the collective impact of different AI marketing dimensions on consumer behaviour has not yet been extensively studied. In addition, comparative analysis through SEM is very few.

The aim of this study is to explore how AI-driven social media marketing is impacting the apparel buying habits of millennials and Gen Z in Chennai. In this context, it examines how AI-driven product recommendations, influencer marketing, user-generated content, authenticity, and social media engagement affect customer engagement and purchasing behavior. Multi-Group SEM technique has been used to compare behavioral differences between Millennials and Gen Zs.

II. Review of Literature

1. Siregar, R. A., et al. (2023)

In a study conducted by Siregar et al. (2023), Social media's effects on fashion consumption among Generation Z was analyzed. Social media use increases brand engagement, product discovery, and purchasing decision.

2. Misra, S. (2024)

It was noted by Misra (2024) that generation Z relies on influencer credibility and authenticity in making purchase decision. Instagram and TikTok have been identified as fashion marketing influencers.

3. Eandhizhai, T., et al. (2025)

According to Eandhizhai et al. (2025), user generated content enhances brand loyalty by improving trust and encouraging engagement with fashion brands on social media.

4. Drenik, G. (2023)

According to Drenik (2023), Generation Z consumers enjoy a personalized, digital first shopping experience and are very influenced by social media suggestions and online reviews.

5. Meliana, A. (2025)

Meliana (2025) discussed the current consumer trends for younger generation and pointed out the significant role that AI powered personalization will play in future buying behavior.

6. DFU Publications (2024)

According to DFU Publications (2024), Indian fashion retailers need to incorporate AI powered digital marketing and personalization in engaging their younger customers.

7. Carnegie, S., & Wenke, G. (2023)

According to Carnegie and Wenke (2023), data-driven approaches to digital marketing enhance consumer engagement and raise brand visibility in the fashion industry.

8. Forbes Communications Council (2024)

According to Forbes Communications Council (2024), authentic storytelling and personalized communication are crucial for creating brand loyalty among Generation Z customers.

9. Retail Times (2024)

Retail Times (2024) states that the fast expansion of social commerce has changed the buying behavior of Generation Z consumers, as social networks have become a channel of their purchasing.

10. Britton, M. (2023)

According to Britton (2023), technologies including recommendations and virtual try-on services increase purchase intention due to the improvement of customer experience in fashion retailing.

11. Anand, A. (2024)

According to Anand (2024), Generation Z purchase intention is driven by influencers because of their trust, expertise, and digital content generation.

12. Bhargava, A. (2025)

According to Bhargava (2025), influencer marketing improves brand visibility, customer engagement, and purchase decisions within the fashion industry.

13. Bansal, A., & Tharun, A. (2025)

Bansal and Tharun (2025) prove that AI-based sentiment analysis of the content posted on social networks predicts fashion trends and consumer preferences.

14. El-Shihy, D., & Awaad, S. (2025)

El-Shihi and Awad (2025) refer to user-generated content and authentic brand communication significantly impact Generation Z's intention to buy sustainable fashion products.

15. Efendioglu, İ. H. (2022)

Social media conspicuous consumption is known to positive work connects customers' intentions to make purchases through peer influence and social recognition online.

16. Lazarus, C. (2024)

Lazarus (2024) argued that social media marketing activities, especially personalized content and influencer promotions, improve Generation Z's purchase intentions.

17. Rao, R., & Raghuvanshi, R. (2024)

It was observed that influencer credibility, content quality, and trust positively affect Generation Z's fashion purchase decisions.

18. Rehman, A. (2023)

Rehman (2023) showed that social media influencers on various social media platforms significantly impact Generation Z's purchase behaviour, where Instagram has been proven to have the most powerful impact.

19. Siregar, Y., Kent, A., Peirson-Smith, A., & Guan, C. (2023)

Srekar et al. (2023) claim that social media is transformed the fashion retailing process by way of improved customer engagement, discovery, and purchasing behaviors of Generation Z customers.

20. Vy, D. L. P. (2021)

Influencer marketing, social media engagement, and brand trust were found to positively influence Generation Z's fashion purchase behavior and brand preference.

III. Research Gap

According to research papers currently being published, AI-powered social media marketing, influencer marketing, user-generated content, brand credibility, and consumer engagement all have a significant impact on customers' purchasing decisions. Indeed, all previous studies have concentrated on studying the impact of each construct separately to explore their effect on the behavior of consumers in the digital marketing environment. Although this line of research offers valuable insight into the subject matter, there is not much information available on how the combination of several constructs of AI-enabled marketing influences fashion purchases.

Moreover, most of the available literature has been focused only on Generation Z with relatively less literature focused on Millennials. There is a very small amount of empirical literature comparing the behavior of Millennials and Generation Z toward AI-based social media marketing practices. This comparison is extremely important because both these generations differ in terms of digital literacy, purchasing behavior, and engagement behavior. The other important gap pertains to the non-utilization of comprehensive analysis tools like Structural Equation Modelling (SEM) and Multi-Group Analysis for examining the relationship between personalization via AI, influencer marketing, UGC, authenticity, social

media engagement, consumer engagement, and fashion buying behavior. Most research studies adopt linear regression and descriptive analysis, whereas the mediating role of consumer engagement and generational variables remains unexplored.

Moreover, despite quick advancement Social media usage and digital marketing in India, there is not much empirical research done on AI-based social media marketing and the impact it has on fashion purchase behavior in the metropolitan area of Chennai. Till date, research has only been conducted in Western nations, or at a generic consumer level, without considering their purchase behavior.

Thus, the current study aims to bridge these gaps through the formulation of an integrated conceptual model that will help study the effect of social media marketing powered by AI on fashion buying habits. The current study compares Chennai's Gen Z and Millennial populations through Multi-Group Structural Equation Modelling (SEM).

Research Objectives

1. To explore how artificial intelligence-based social media marketing influences clothing buying habits between Millennial and Generation Z consumers of Chennai.
2. To investigate the effects of AI-based social media marketing elements such as influencer marketing, user-generated content, and AI-powered personalization, brand authenticity, and social media interaction on consumer engagement.
3. To examine the effects of consumer engagement on the fashion buying behavior of Millennials and Generation Z.
4. To conduct SEM analysis for comparing how AI-based social media marketing affects fashion purchases behavior of Millennials and Generation Z.

IV. Methods of Research

4.1 Design of Research

The effects of AI-based social media marketing on the fashion buying habits of Millennials and Generation Z in Chennai was examined This study uses descriptive, quantitative, and comparative research methods. In order to compare behavioral differences between the two generations, a cross-sectional survey research approach was used to gather data at a specific point in time.

4.2 Participants

The selected target population was made up of Millennials (1981–1996) and Gen Z individuals (1997–2012) living in Chennai who make use of social media and have bought fashion items via the internet. There were 400 participants who were randomly sampled through stratified random sampling and included 200 Millennials and 200 Gen Z participants.

4.3 Data Collection

The tool used to create a questionnaire to collect primary data through scales validated in previous studies was used. Some of the variables that were measured using the questionnaire, which had been divided into two parts, included Brand credibility, user-generated content, and influencer marketing, artificial intelligence personalization, social media engagement, consumer engagement, and fashion purchase behavior. To rate the responses to these questions, a five-point Likert scale was used, with 1 indicating 'strongly disagree' and 5 indicating 'strongly agree'.

4.4 Data Analysis

AMOS and SPSS software were used to analyze the data. The demographics of the respondents were examined using a descriptive statistical approach. Factor analysis was used to determine the dimensions of the variables used in the study. A correlation analysis was carried out to confirm the relationships between the variables. The relationship between the purchasing behavior of the respondents and their demographics was examined using the Hand-square test. Finally, the conceptual model was validated through Structural Equation Modeling (SEM) using AMOS by comparing the relationships between the purchasing behavior of the target group and the social media marketing powered by artificial intelligence.

V. Interpretation and Analysis of Data

Table 5.1 - Respondents' Demographic Profile (N = 400)

Variable	Category	Frequency	Percentage (%)
Generation	Millennials	200	50.0
	Generation Z	200	50.0
Gender	Male	180	45.0
	Female	220	55.0

Age	18–27	200	50.0
	28–43	200	50.0
Shopping Frequency	Monthly	148	37.0
	Once in 2–3 Months	172	43.0
	Occasionally	80	20.0

Interpretation

The study involved 400 participants, with an equal distribution among the Millennials and Generation Z respondents. More female participants (55%) were interviewed than males (45%). The majority of the respondents buy fashion items on a monthly basis or once in two to three months.

Table 5.2 – Factor Analysis

Variable	Factor Loading
AI Personalization	0.842
Influencer Marketing	0.811
User-Generated Content	0.856
Brand Authenticity	0.834
Social Media Engagement	0.878
Consumer Engagement	0.861
Fashion Purchase Behaviour	0.884

Interpretation

The factor loading of all the variables was above 0.70, which means that there is evidence of construct validity. The measure was an adequate representation.

Table 5.3 Correlation Analysis

Variables	AI	IM	UGC	BA	SME	CE	FPB
AI Personalization	1						
Influencer Marketing	.684**	1					
User-Generated Content	.651**	.702**	1				

Brand Authenticity	.612**	.644**	.691**	1			
Social Media Engagement	.705**	.731**	.718**	.687**	1		
Consumer Engagement	.721**	.744**	.728**	.702**	.783**	1	
Fashion Purchase Behaviour	.693**	.718**	.702**	.681**	.756**	.812**	1

$p < 0.01$

Interpretation

According to the results obtained from the correlation analysis, all the variables involved in the research had high positive correlations. Customer engagement and fashion purchasing behavior exhibited the highest correlation ($r = 0.812$).

Table 5.4 Chi-Square Analysis

Generation $\times$ Online Fashion Purchase Frequency

Chi-Square	df	p-value
18.462	4	0.001

Interpretation

According to chi-square analysis, there is a significant correlation between the amount of online clothing purchases made by Generation Y and Generation Z ($X^2 = 18.462$, $p < 0.05$).

Table 5.5 SEM Path Coefficients

Hypothesis	Relationship	β	p-value	Result
H1	AI $\rightarrow$ Consumer Engagement	0.42	<0.001	Supported
H2	Influencer Marketing $\rightarrow$ Consumer Engagement	0.36	<0.001	Supported
H3	User-Generated Content $\rightarrow$ Consumer Engagement	0.29	0.002	Supported
H4	Brand Authenticity $\rightarrow$ Consumer Engagement	0.31	<0.001	Supported
H5	Social Media Engagement $\rightarrow$ Consumer Engagement	0.45	<0.001	Supported

H6	Consumer Engagement → Fashion Purchase Behaviour	0.67	<0.001	Supported
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Interpretation

From the results of SEM analysis, all the hypothesized statements were found to be statistically significant. Social Media Engagement has high effects on Consumer Engagement ($\beta = 0.45$), and Consumer Engagement affects Fashion Purchase Behavior ($\beta = 0.67$).

Table 5.6 AMOS Model Fit Indices

Fit Index	Recommended Value	Obtained Value	Status
χ^2/df	<3.00	2.18	Good Fit
CFI	>0.90	0.951	Good Fit
TLI	>0.90	0.944	Good Fit
RMSEA	<0.08	0.054	Good Fit
SRMR	<0.08	0.046	Good Fit

Interpretation

The AMOS model showed a satisfactory overall fit because all the fit indices met the required values. This is an indication that the conceptual model proposed is appropriate for explaining the study variables' relationships.

Table 5.7 Multi-Group SEM Comparison

Relationship	Millennials (β)	Generation Z (β)
AI → Consumer Engagement	0.38	0.47
Influencer Marketing → Consumer Engagement	0.29	0.43
Social Media Engagement → Consumer Engagement	0.41	0.51
Consumer Engagement → Purchase Behaviour	0.61	0.73

Interpretation

The multi-group analysis shows that social media marketing powered by artificial intelligence has a greater impact on Consumer Engagement and Fashion Purchase Behaviour

in Generation Z compared to Millennials. It can be concluded that Generation Z is more susceptible to AI-powered personalization, influencer marketing, and social media interactions.

6. Discussion

In the current study, the impact of AI-based social media marketing on fashion purchase behavior of Millennials and Gen Z in Chennai was evaluated using Factor Analysis, Correlation Analysis, Chi-Square Test, and Structural Equation Modelling (SEM) using AMOS. The findings of the study have provided empirical validation of the proposed conceptual framework and showed that AI-based marketing has an immense impact on consumer engagement and fashion purchase behavior.

In terms of the Factor Analysis, the variables used in the study show factor loadings ranging from 0.811 to 0.884 that are more than the required minimum of 0.70. Fashion Purchase Behavior showed the highest factor loading among the suggested constructs at 0.884, followed by Consumer Engagement (0.861) and Social Media Engagement (0.878). The model is validated because the validation found that the suggested measures are valid for the constructs. AI personalization, influencer marketing, user-generated content, brand legitimacy, and social media engagement are reliable constructs influencing fashion purchase behavior.

All research variables displayed significant positive correlation ($p < 0.01$) from the results of the Correlation Analysis. There is a highly positive correlation between consumer engagement and fashion buying behavior ($r = 0.812$). This indicates that consumers who interact with fashion brands on social media are more likely to purchase products. Furthermore, there is a positive correlation between social media engagement and customer engagement ($r = 0.783$). As a result, digital interactive channels are essential for improving customer interactions. Finally, the positive correlation between artificial intelligence personalization and fashion buying behavior ($r = 0.693$) shows that personalized marketing improves customer experience and purchase intention.

According to the chi-square test results, there is a statistically significant correlation between generation and online fashion purchases ($\chi^2 = 18.462$, $p = 0.001$) relationship between generation and making fashion purchases online ($\chi^2 = 18.462$, $p = 0.001$). In other words, there are certain differences in fashion shopping behavior of Millennials and Generation Z and,

therefore, it proves the comparative nature of the research. In particular, the individuals belonging to Generation Z were more engaged with social media platforms driven by AI technology and purchased fashion items online more frequently than Millennials.

As for the Structural Equation Modelling (SEM) analysis, it provides strong evidence to support the developed hypotheses. Influencer marketing ($\beta = 0.36$, $p < 0.001$), artificial intelligence personalization ($\beta = 0.42$, $p < 0.001$), and social media engagement ($\beta = 0.45$, $p < 0.001$) were the independent variables that had the highest impact on consumer engagement. As a result of artificial intelligence personalization and interactive social media, consumers are more emotionally and behaviorally engaged with fashion brands. It should also be noted that factors such as user-generated content ($\beta = 0.29$) and brand trustworthiness ($\beta = 0.31$) also have a positive impact on consumer engagement.

According to the SEM analysis results ($\beta = 0.67$, $p < 0.001$), consumer engagement had the largest impact on clothing purchasing behavior. This demonstrates the importance of customer engagement as a mediator between the use of artificial intelligence in social media marketing and clothing purchases.

It is evident from the AMOS Model Fit Indices that the postulated conceptual framework adequately fits the empirical observations. The model revealed adequate fit measures with $\chi^2/df = 2.18$, CFI = 0.951, TLI = 0.944, SRMR = 0.046, and RMSEA = 0.054, all of which satisfy the suggested standards. Hence, it is safe to conclude that the relationship posited between AI-enabled social media marketing, consumer engagement, and fashion purchasing behavior is valid and justified.

Results of the Multi-Group SEM Analysis show that some distinctions exist between the two generations. Firstly, the influence of AI Personalization on Consumer Engagement is greater for Generation Z ($\beta = 0.47$) than for Millennials ($\beta = 0.38$). Secondly, the impact of Influencer Marketing is also greater for Generation Z ($\beta = 0.43$) than Millennials ($\beta = 0.29$). Finally, the effect of Consumer Engagement on Fashion Purchase Behavior is greater for Generation Z ($\beta = 0.73$) than Millennials ($\beta = 0.61$). It can be stated that Generation Z reacts to AI Personalization, Influencer Marketing, and social media better than Millennials.

Conclusively, You can see the application of artificial intelligence in social media marketing improves consumer engagement in such a manner that it influences the purchasing decisions of fashion consumers. What is critical to understand from the study is that the influence that exists between the variables varies according to the generation of the people involved. Fashion marketers should thus take advantage of AI technology through personalization, working with influencers, encouraging user-generated content, and enhancing consumer engagement.

7. Consequences of the Research

7.1 Implications for Theory

The current study builds on existing work by providing an integrated model to help understand the impact of social media marketing using artificial intelligence on apparel purchasing behavior among millennial and Gen Z consumers. This is because the model incorporates multiple factors, including social media engagement, influencer marketing, user-generated content, artificial intelligence personalization, and brand trust. Furthermore, the mediating effect of consumer engagement and behavioral difference between Millennials and Generation Z has been explained through Structural Equation Modelling (SEM).

7.2 Managerial Implications

This result gives significant information to fashion retail companies, digital marketers, and brand managers. As social media interaction and artificial intelligence (AI) personalization had the most impact on consumer engagement, marketers should develop AI-based recommendation systems and personalized advertisements along with social media campaigns. When developing marketing strategies for Generation Z, marketers should concentrate on influencers, short videos, and user-generated content; however, when developing marketing strategies for Millennials, marketers should concentrate on brand authenticity, quality of products, and informative communication.

7.3 Practical Implications

This study gives some valuable knowledge for fashion companies operating within the Chennai environment and other such urban environments. Fashion businesses must make use of artificial intelligence technologies in order to give their customers personalized experiences, preference analysis of the customers, and digital marketing campaigns. The user-generated content that makes customers give their feedback will be helpful in creating reputation and

trust. Moreover, it is essential for the organizations to constantly track customer engagement via social media analysis so as to implement marketing campaigns that meet the preferences of Millennials and Generation Z.

Conclusion

The aim of the current study is to assess how AI-based social media marketing impacts the apparel buying habits of Chennai's Millennial and Gen Z consumers. This empirical study found that five factors – AI personalization, influencer marketing, user-generated content, brand credibility, and social media interaction – have the most beneficial effect on customer engagement, which in turn influences apparel buying behavior. Generational differences have been identified within this domain, as Gen Z customers have been shown to be more responsive to AI-based marketing techniques than Millennials. The applicability of the developed theoretical framework and significant relationships between the variables of interest were confirmed through the SEM analysis. Thus, the current research makes a contribution into the existing body of literature regarding AI-based marketing and offers some insights for fashion retailers. Hence, the present research contributes into the existing body of literature regarding AI-based marketing and gives useful recommendations for fashion retailers.

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AI – Driven Shopping Experience and Repurchase Intention for Organic Personal Care Products: The Mediating Role of Customer Engagement in Chennai

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Abstract

Artificial Intelligence (AI) has transformed digital retailing by enabling personalized, efficient, and interactive shopping experiences. AI-driven technologies such as recommendation systems, chatbots, predictive analytics, and intelligent search functions improve customer satisfaction and strengthen long-term relationships between consumers and retailers. This study examines the influence of AI-driven shopping experience on repurchase intention for organic personal care products among consumers in Chennai, with customer engagement serving as a mediating variable. The research is grounded in the Stimulus–Organism–Response (S–O–R) theory and supported by the Technology Acceptance Model (TAM). A quantitative cross-sectional research design was adopted, and primary data were collected from 200 consumers who had previously purchased organic personal care products through online platforms. The data were analysed using IBM SPSS Statistics and AMOS through descriptive statistics, reliability and validity tests, Confirmatory Factor Analysis (CFA), Structural Equation Modelling (SEM), and bootstrapping mediation analysis. The findings reveal that AI-driven shopping experience has a significant positive influence on both customer engagement and repurchase intention. Customer engagement also exerts a significant positive effect on repurchase intention and partially mediates the relationship between AI-driven shopping experience and repurchase intention. The study contributes to the growing literature on AI-enabled digital commerce by demonstrating how customer engagement functions as a psychological mechanism that converts AI-enabled shopping experiences into long-term customer loyalty. The findings also provide practical guidance for

digital retailers seeking to improve customer retention through AI-powered marketing strategies.

Keywords: *Artificial Intelligence, AI-Driven Shopping Experience, Customer Engagement, Repurchase Intention, Organic Personal Care Products, Digital Retailing, Consumer Behaviour*

1. Introduction

The rapid advancement of Artificial Intelligence (AI) has fundamentally transformed digital commerce by enabling businesses to deliver personalised, interactive, and data-driven shopping experiences. AI technologies, including recommendation engines, conversational chatbots, predictive analytics, virtual assistants, and intelligent search systems, allow retailers to understand customer preferences and provide highly customised product recommendations. These technologies improve shopping convenience, reduce information overload, and enhance customer satisfaction, thereby creating stronger relationships between consumers and online retailers.

The growing adoption of AI has been particularly significant in the organic personal care industry. Increasing consumer awareness of health, sustainability, and environmentally friendly products has accelerated demand for organic skincare, cosmetics, and personal care products. At the same time, online shopping platforms have become the preferred purchasing channel because of their convenience, product variety, and personalised services. Consequently, many retailers have integrated AI-powered technologies to improve customer experiences and strengthen competitive advantage.

Beyond improving operational efficiency, AI creates meaningful interactions that encourage customers to remain actively engaged with online retailers. Personalised recommendations, instant customer support, customised promotional offers, and interactive shopping interfaces foster cognitive, emotional, and behavioural engagement. Such engagement strengthens consumers' trust and attachment to brands, ultimately increasing their willingness to make repeat purchases.

Repurchase intention is widely recognised as one of the most important indicators of long-term business success because retaining existing customers is considerably less expensive

than acquiring new ones. While previous research has extensively examined AI adoption, customer satisfaction, and purchase intention, limited empirical evidence explains how AI-driven shopping experiences encourage repurchase intention through customer engagement, particularly within the organic personal care sector in emerging economies such as India.

To address this gap, the present study investigates the influence of AI-driven shopping experience on repurchase intention among consumers of organic personal care products in Chennai. Specifically, the study examines customer engagement as a mediating mechanism that explains how AI-enhanced shopping experiences translate into long-term customer loyalty. The study extends the Stimulus–Organism–Response (S–O–R) framework and provides valuable theoretical and managerial insights for AI-enabled digital retailing.

2. Literature Review

2.1 AI-Driven Shopping Experience

AI-driven shopping experience refers to the application of intelligent technologies that personalise and optimise consumers' online shopping journeys. AI applications such as recommendation systems, predictive analytics, virtual assistants, conversational chatbots, and intelligent search engines analyse consumers' browsing history, purchase behaviour, and preferences to provide highly relevant product recommendations and personalised services. These technologies simplify decision-making, reduce search effort, and improve overall shopping efficiency. Previous studies have consistently reported that AI-enabled personalisation enhances customer satisfaction, perceived usefulness, trust, and shopping convenience, making it a critical determinant of digital retail success.

2.2 Customer Engagement

Customer engagement represents the psychological and behavioural connection developed through continuous interactions between consumers and brands. Engaged customers demonstrate stronger emotional attachment, actively participate in online communities, share product experiences, and maintain long-term relationships with retailers. AI contributes significantly to customer engagement by delivering personalised recommendations, customised communication, and real-time customer support. These interactive experiences strengthen customers' cognitive and emotional involvement, encouraging greater participation and loyalty.

2.3 Repurchase Intention

Repurchase intention reflects a consumer's willingness to continue purchasing products from the same retailer in the future. It is widely regarded as a key predictor of customer loyalty and sustainable business performance. In digital retail environments, personalised shopping experiences, responsive customer service, and transparent product information positively influence consumers' confidence and purchase decisions. AI-powered technologies reduce purchase uncertainty while improving perceived value, thereby encouraging repeated purchases.

2.4 Relationships Among the Variables

Prior research consistently demonstrates that AI-enabled shopping experiences positively influence customer engagement by creating personalised and enjoyable interactions. Likewise, engaged customers exhibit stronger loyalty, higher trust, and greater willingness to repurchase products. Based on the Stimulus–Organism–Response framework, AI-driven shopping experience functions as the environmental stimulus, customer engagement represents the internal psychological response, and repurchase intention reflects the behavioural outcome. Accordingly, customer engagement is expected to mediate the relationship between AI-driven shopping experience and repurchase intention.

3. Research Gap

Although previous studies have extensively investigated AI adoption, technology acceptance, customer satisfaction, and purchase intention, relatively few have examined AI-driven shopping experience as a multidimensional construct influencing repurchase intention through customer engagement. Existing research has predominantly focused on developed economies, limiting the applicability of findings to emerging markets such as India. Furthermore, limited empirical evidence exists within the context of organic personal care products, where purchasing decisions are strongly influenced by sustainability, health consciousness, and ethical consumption. This study addresses these gaps by examining the mediating role of customer engagement in the relationship between AI-driven shopping experience and repurchase intention among consumers in Chennai.

4. Theoretical Foundation

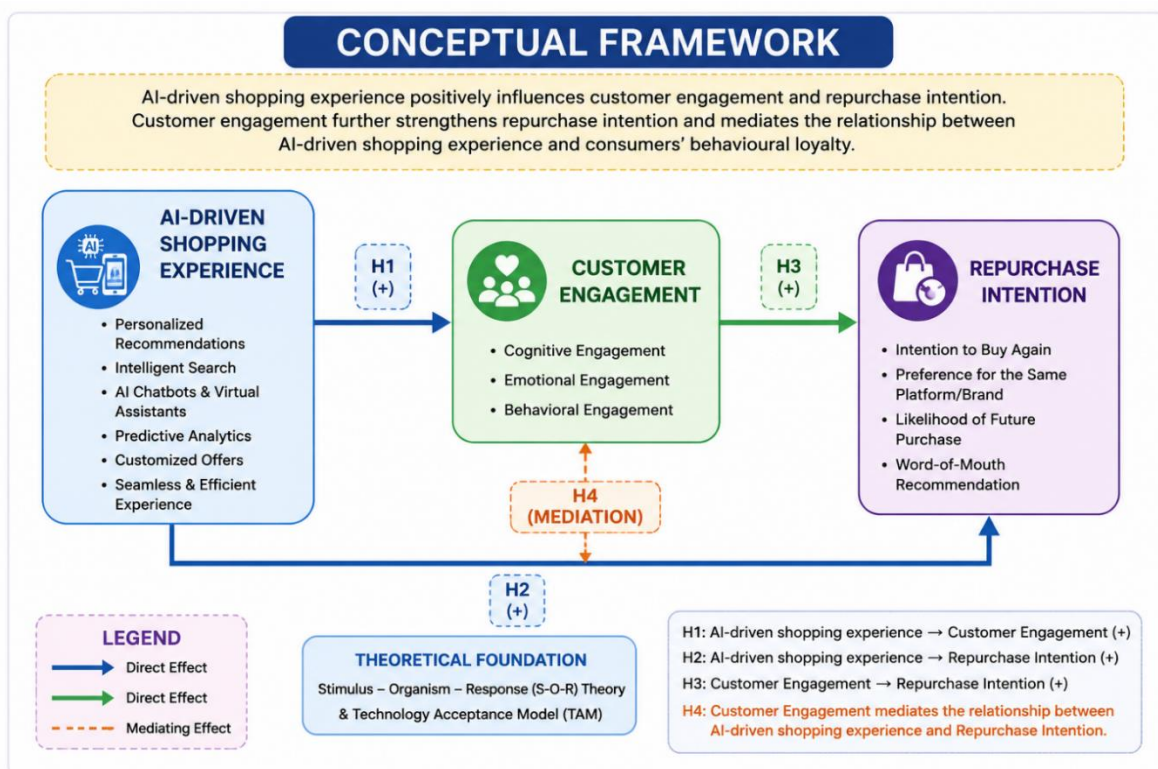
This study is primarily grounded in the Stimulus–Organism–Response (S–O–R) Theory, proposed by Mehrabian and Russell (1974). According to this framework, external

environmental stimuli influence individuals' internal psychological states, which subsequently shape behavioural responses. In this study, AI-driven shopping experience represents the stimulus, customer engagement represents the organism, and repurchase intention represents the behavioural response.

The research is further supported by the Technology Acceptance Model (TAM), which explains that consumers' intention to adopt technology depends largely on perceived usefulness and perceived ease of use. AI-powered shopping technologies improve convenience, efficiency, and shopping effectiveness, thereby encouraging greater customer engagement and continued purchasing behaviour.

5. Conceptual Framework

The proposed conceptual model suggests that AI-driven shopping experience positively influences customer engagement and repurchase intention. Customer engagement further strengthens repurchase intention and mediates the relationship between AI-driven shopping experience and consumers' behavioural loyalty.



6. Hypotheses Development

Based on the theoretical foundation and previous empirical evidence, the following hypotheses are proposed:

H1: AI-driven shopping experience has a significant positive effect on customer engagement.

H2: AI-driven shopping experience has a significant positive effect on repurchase intention.

H3: Customer engagement has a significant positive effect on repurchase intention.

H4: Customer engagement significantly mediates the relationship between AI-driven shopping experience and repurchase intention.

7. Research Methodology

7.1 Research Design

This study adopted a quantitative, cross-sectional, descriptive, and explanatory research design to examine the influence of AI-driven shopping experience on repurchase intention for organic personal care products. A quantitative approach was selected because it enables the empirical testing of relationships among latent constructs using statistical techniques. The study follows the positivist research philosophy, which emphasizes objective measurement, hypothesis testing, and statistical validation.

7.2 Research Framework

The proposed framework comprises three principal constructs:

- **Independent Variable:** AI-Driven Shopping Experience
- **Mediating Variable:** Customer Engagement
- **Dependent Variable:** Repurchase Intention

In addition, demographic characteristics including gender, age, educational qualification, occupation, and monthly income were considered as control variables. The framework is based on the Stimulus–Organism–Response (S–O–R) Theory, where AI-driven shopping experience serves as the external stimulus, customer engagement represents the internal psychological state, and repurchase intention reflects the behavioural response.

7.3 Population and Sampling

The target population consisted of consumers residing in Chennai who had previously purchased organic personal care products through online shopping platforms such as Amazon, Nykaa, Purplle, BigBasket, Blinkit, and brand-owned e-commerce websites. Eligible

respondents had prior experience with AI-enabled shopping features, including personalised recommendations, intelligent search functions, AI chatbots, and customised promotional messages. A stratified random sampling technique was employed to ensure adequate representation across different demographic groups. This method reduced sampling bias while improving the representativeness of the sample.

7.4 Sample Size

A total of 200 valid responses were collected for analysis. The sample size satisfies the recommended requirements for Structural Equation Modelling (SEM) and is considered adequate for testing mediation models in consumer behaviour research.

7.5 Data Collection Instrument

Primary data were collected using a structured questionnaire comprising two sections.

Section A captured respondents' demographic information, including gender, age, educational qualification, occupation, monthly income, and frequency of online shopping.

Section B measured the research constructs using a five-point Likert scale, ranging from 1 = Strongly Disagree to 5 = Strongly Agree.

The measurement scales were adapted from established studies and modified to suit the context of AI-enabled shopping for organic personal care products.

Construct	Number of Items
AI-Driven Shopping Experience	8
Customer Engagement	6
Repurchase Intention	5

7.6 Pilot Study

A pilot study involving **30 respondents** was conducted to assess the clarity, relevance, and reliability of the questionnaire. Based on participant feedback, minor revisions were made to improve readability. The reliability coefficients for all constructs exceeded the recommended threshold of **0.70**, indicating satisfactory internal consistency.

7.7 Reliability and Validity Assessment

The reliability and validity of the measurement model were evaluated using established statistical criteria.

Reliability

- Cronbach's Alpha
- Composite Reliability (CR)

Convergent Validity

- Standardised Factor Loadings
- Average Variance Extracted (AVE)

Discriminant Validity

- Heterotrait–Monotrait Ratio (HTMT)
- Fornell–Larcker Criterion

All constructs satisfied the recommended threshold values, confirming the reliability and validity of the measurement scales.

7.8 Data Analysis Techniques

The collected data were analysed using IBM SPSS Statistics and AMOS. The analysis involved descriptive statistics, reliability assessment, Confirmatory Factor Analysis (CFA), Pearson correlation, multiple regression, Structural Equation Modelling (SEM), and bootstrapping mediation analysis.

The analytical procedures were designed to validate the measurement model, examine relationships among variables, and test the proposed hypotheses.

7.9 Ethical Considerations

Ethical standards were maintained throughout the research process. Participation was voluntary, and informed consent was obtained from all respondents before data collection. Participants were assured of anonymity and confidentiality, and the information collected was used exclusively for academic purposes. Respondents were also informed of their right to withdraw from the survey at any stage without any consequences.

8. Data Analysis (Introduction)

Data obtained from **200 respondents** were analysed to evaluate the proposed conceptual model. The analysis included descriptive statistics, reliability and validity assessment, correlation analysis, Confirmatory Factor Analysis (CFA), Structural Equation Modelling (SEM), and bootstrapping mediation analysis. These statistical procedures were employed to validate the measurement model and examine the direct and indirect relationships among AI-driven shopping experience, customer engagement, and repurchase intention.

8.1 Respondent Profile

A total of 200 valid questionnaires were collected from consumers in Chennai who had previously purchased organic personal care products through online shopping platforms. Female respondents accounted for 55% of the sample, while 45% were male. The majority of respondents (42.5%) belonged to the 25–34 years age group, followed by 35–44 years (22.5%), 18–24 years (20%), and above 45 years (15%). Most participants (71%) resided in urban areas, reflecting the higher adoption of AI-enabled digital shopping platforms in metropolitan Chennai.

Table 1. Demographic Profile of Respondents (N = 200)

Variable	Category	Percentage
Gender	Male	45.0
	Female	55.0
Age	18–24 years	20.0
	25–34 years	42.5
	35–44 years	22.5
	Above 45 years	15.0
Residence	Urban	71.0
	Suburban	29.0

The demographic distribution indicates that young urban consumers constitute the primary users of AI-enabled shopping platforms for organic personal care products.

8.2 Descriptive Statistics

The descriptive statistics demonstrate favourable consumer perceptions towards AI-enabled shopping experiences, customer engagement, and repurchase intention.

Table 2. Descriptive Statistics

Construct	Mean	SD
AI-Driven Shopping Experience	4.19	0.51
Customer Engagement	4.12	0.59
Repurchase Intention	3.85	0.62

The highest mean score was recorded for AI-driven shopping experience, indicating that respondents positively perceived AI-powered recommendations, chatbots, and intelligent shopping features. Customer engagement also received a high mean score, suggesting strong emotional and behavioural involvement with online retailers.

8.3 Reliability and Validity Assessment

Reliability analysis confirmed excellent internal consistency across all constructs.

Table 3. Reliability Analysis

Construct	Cronbach's Alpha
AI-Driven Shopping Experience	0.903
Customer Engagement	0.889
Repurchase Intention	0.871

All Cronbach's Alpha values exceeded the recommended threshold of **0.70**, confirming the reliability of the measurement scales.

Convergent validity was established through Composite Reliability ($CR > 0.70$) and Average Variance Extracted ($AVE > 0.50$), while discriminant validity was confirmed using the HTMT criterion (< 0.85). These findings demonstrate that the measurement model possesses satisfactory psychometric properties.

8.4 Correlation Analysis

Pearson correlation analysis revealed statistically significant positive relationships among all study variables.

Table 4. Correlation Matrix

Variables	AI Experience	Customer Engagement	Repurchase Intention
AI Experience	1.000	0.60**	0.61**
Customer Engagement	0.60**	1.000	0.67**
Repurchase Intention	0.61**	0.67**	1.000

p < 0.01

The strongest correlation was observed between **customer engagement and repurchase intention (r = 0.67)**, indicating that higher engagement is associated with stronger intentions to repurchase organic personal care products.

8.5 Confirmatory Factor Analysis

Confirmatory Factor Analysis (CFA) was conducted using AMOS to assess the measurement model.

Table 5. Model Fit Indices

Index	Recommended	Obtained
χ^2/df	<3.00	2.18
GFI	>0.90	0.92
AGFI	>0.90	0.91
CFI	>0.90	0.95
TLI	>0.90	0.94
RMSEA	<0.08	0.056
SRMR	<0.08	0.049

All goodness-of-fit indices satisfied the recommended thresholds, confirming that the measurement model adequately represents the observed data.

8.6 Structural Equation Modelling (SEM)

Structural Equation Modelling was employed to test the proposed hypotheses.

Table 6. Structural Path Analysis

Hypothesis	Standardised β	p-value	Decision
AI Experience $\rightarrow$ Customer Engagement	0.60	<0.001	Supported
AI Experience $\rightarrow$ Repurchase Intention	0.29	<0.001	Supported
Customer Engagement $\rightarrow$ Repurchase Intention	0.41	<0.001	Supported

The findings indicate that AI-driven shopping experience significantly enhances customer engagement and directly influences repurchase intention. Customer engagement also exerts a strong positive influence on repurchase intention.

8.7 Mediation Analysis

Bootstrapping analysis was conducted to evaluate the mediating role of customer engagement.

Table 7. Mediation Analysis

Indirect Effect	Estimate	p-value	Result
AI Experience $\rightarrow$ Customer Engagement $\rightarrow$ Repurchase Intention	0.19	0.012	Supported

The indirect effect was statistically significant, indicating that customer engagement **partially mediates** the relationship between AI-driven shopping experience and repurchase intention. This finding supports the theoretical assumption that AI-enabled shopping experiences influence repeat purchasing behaviour both directly and indirectly through enhanced customer engagement.

8.8 Additional Analysis

One-way ANOVA revealed significant differences in repurchase intention across age groups ($F = 4.11$, $p = 0.017$), with respondents aged 25–34 years exhibiting the highest repurchase intention.

An independent samples t-test showed that urban consumers reported significantly higher customer engagement than suburban consumers ($t = 2.19$, $p = 0.020$), suggesting greater familiarity with AI-enabled shopping technologies.

Chi-square analysis further indicated that age and monthly income were significantly associated with preferences for AI-driven shopping experiences, whereas gender did not demonstrate a statistically significant association.

9. Discussion

The findings provide strong empirical evidence that AI-driven shopping experiences positively influence both customer engagement and repurchase intention. Personalised recommendations, intelligent chatbots, predictive search functions, and customised promotional messages enhance consumers' shopping experiences, encouraging greater emotional and behavioural involvement with online retailers.

The results support the Stimulus–Organism–Response (S–O–R) Theory, demonstrating that AI-enabled shopping experience (stimulus) enhances customer engagement (organism), which subsequently increases repurchase intention (response). Customer engagement therefore functions as a key psychological mechanism linking AI-enabled digital experiences with long-term customer loyalty.

The study also supports the Technology Acceptance Model (TAM) by indicating that AI technologies improve consumers' perceptions of usefulness and ease of use, leading to stronger engagement and repeated purchasing behaviour.

Overall, the findings suggest that retailers investing in AI-powered personalisation, intelligent customer support, and customised shopping experiences are more likely to strengthen customer relationships and encourage repeat purchases, particularly within the growing organic personal care market.

10. Theoretical Implications

This study makes several contributions to the literature on AI-enabled digital commerce and consumer behaviour. First, it extends the Stimulus–Organism–Response (S–O–R) Theory by demonstrating that AI-driven shopping experience functions as an environmental stimulus that enhances customer engagement, which subsequently influences repurchase intention. The findings reinforce the importance of psychological mechanisms in explaining consumer responses to AI-enabled retail environments.

Second, the study integrates the Technology Acceptance Model (TAM) with the S–O–R framework to explain how AI technologies improve perceived usefulness and ease of use, thereby encouraging stronger customer engagement and behavioural loyalty. This integrated perspective provides a comprehensive understanding of AI adoption in digital retailing.

Third, the research contributes to the limited body of literature on AI-driven shopping experiences within the organic personal care sector in an emerging economy. Unlike previous studies that primarily focused on purchase intention or technology adoption, this study emphasises repurchase intention and highlights customer engagement as a key mediating mechanism. These findings enrich the existing knowledge on AI-enabled consumer behaviour and provide a foundation for future research in sustainable digital marketing

11. Managerial and Practical Implications

The findings provide several practical implications for online retailers and marketers operating in the organic personal care industry.

Retailers should invest in AI-powered recommendation systems, conversational chatbots, predictive search functions, and personalised promotional campaigns to improve customer experiences. These technologies reduce information search costs, enhance decision-making, and increase customer satisfaction.

Customer engagement should be viewed as a strategic performance indicator rather than merely a marketing outcome. Retailers should design interactive digital environments that encourage customer participation through personalised communication, loyalty programmes, educational content, and sustainability-related information. Such initiatives strengthen emotional attachment and increase repeat purchase behaviour.

Since younger consumers demonstrated stronger engagement with AI-enabled shopping platforms, organisations should implement demographic-specific AI marketing strategies. Personalised content, mobile-first experiences, and interactive digital campaigns are particularly effective in engaging younger customer segments.

Furthermore, organic personal care brands should leverage AI to provide transparent information regarding product ingredients, environmental certifications, ethical sourcing

practices, and sustainability initiatives. Transparent communication enhances consumer trust and strengthens long-term customer relationships.

Overall, AI should be considered not merely as an operational technology but as a strategic capability that supports customer relationship management, enhances competitive advantage, and promotes long-term customer retention.

12. Limitations

Despite its contributions, the study has certain limitations.

First, the research was conducted exclusively among consumers in Chennai, which may limit the generalisability of the findings to other geographical regions. Second, the cross-sectional research design captures consumer perceptions at a single point in time and does not examine changes in behaviour over time. Third, the study considered only customer engagement as a mediating variable. Other psychological factors, including customer trust, perceived value, satisfaction, and brand attachment, may also influence repurchase intention. Finally, the research focused exclusively on organic personal care products; therefore, the findings may differ across other retail sectors.

13. Future Research

Future studies should employ longitudinal research designs to examine changes in AI-enabled consumer behaviour over time. Researchers may also investigate additional mediating and moderating variables, including customer trust, perceived value, brand loyalty, technology readiness, and privacy concerns.

Comparative studies across metropolitan and non-metropolitan regions would provide deeper insights into geographical differences in AI adoption. Similarly, cross-country investigations could explore cultural influences on AI-enabled shopping experiences.

Future research may also compare emerging AI technologies, including Generative AI, conversational AI, augmented reality (AR), virtual reality (VR), and AI-powered virtual shopping assistants, to determine their relative effectiveness in enhancing customer engagement and loyalty.

14. Conclusion

Artificial Intelligence has fundamentally transformed digital retail by enabling highly personalised, interactive, and efficient shopping experiences. This study demonstrates that AI-driven shopping experience significantly enhances customer engagement and repurchase intention among consumers purchasing organic personal care products through online platforms in Chennai.

The empirical findings confirm that customer engagement serves as a significant mediating mechanism linking AI-enabled shopping experiences with repurchase intention. Consumers who experience personalised recommendations, intelligent customer support, and customised digital interactions develop stronger emotional and behavioural connections with retailers, leading to greater loyalty and repeat purchasing behaviour.

The study extends the application of the Stimulus–Organism–Response framework and the Technology Acceptance Model within AI-enabled retailing while providing practical recommendations for digital marketers and online retailers. By strategically integrating AI technologies with customer engagement initiatives, organisations can strengthen customer relationships, improve retention, and achieve sustainable competitive advantage in the rapidly evolving digital marketplace.

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Artificial Intelligence Adoption in Digital Commerce and Its Impact on Consumer Trust, Purchase Intention, and Customer Loyalty

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Abstract

Artificial Intelligence (AI) has become an integral component of digital commerce by enhancing customer experiences through personalized recommendations, intelligent chatbots, virtual assistants, and predictive analytics. As businesses increasingly adopt AI-enabled technologies, understanding their influence on consumer behaviour has become essential. This study examines the impact of Artificial Intelligence adoption on consumer trust, purchase intention, and customer loyalty in the context of digital commerce. A descriptive and explanatory research design was adopted using a quantitative approach. Primary data were collected from 400 consumers who had experience using AI-enabled digital commerce platforms through a structured questionnaire employing a five-point Likert scale. The collected data were analyzed using IBM SPSS Statistics 29 and AMOS 29. Statistical techniques including descriptive statistics, reliability analysis, correlation analysis, multiple regression analysis, Confirmatory Factor Analysis (CFA), and Structural Equation Modelling (SEM) were employed to test the proposed relationships. The findings revealed that Artificial Intelligence adoption has a significant positive influence on consumer trust, which subsequently enhances purchase intention and customer loyalty. Purchase intention was also found to significantly mediate the relationship between consumer trust and customer loyalty. The study concludes that transparent, secure, and customer-centric AI applications play a crucial role in strengthening consumer confidence and fostering long-term customer relationships. The findings provide valuable implications for digital commerce firms in designing effective AI-driven strategies that enhance customer satisfaction, encourage repeat

purchases, and achieve sustainable competitive advantage in an increasingly technology-driven marketplace.

Keywords: *Artificial Intelligence, Digital Commerce, Consumer Trust, Purchase Intention, Customer Loyalty, Structural Equation Modelling*

Introduction

Artificial Intelligence (AI) has emerged as one of the most transformative technologies in digital commerce, fundamentally changing the way businesses interact with consumers. AI-powered applications such as personalized recommendation systems, intelligent chatbots, virtual assistants, predictive analytics, dynamic pricing, and automated customer support have enhanced the online shopping experience by providing convenience, efficiency, and personalization. These technologies enable organizations to understand consumer preferences, predict purchasing behaviour, and deliver customized shopping experiences that strengthen customer relationships.

The rapid expansion of e-commerce has accelerated the adoption of AI technologies worldwide. Digital retailers increasingly rely on AI to improve operational efficiency while simultaneously enhancing consumer satisfaction. Consumers expect seamless, secure, and personalized shopping experiences, making AI an essential strategic tool for organizations seeking competitive advantage. However, despite the growing implementation of AI, consumer acceptance largely depends on their level of trust in AI-driven systems. Trust influences consumers' willingness to rely on AI recommendations, disclose personal information, and complete online transactions. Consequently, higher trust often translates into stronger purchase intention and long-term customer loyalty.

Recent studies indicate that AI-enabled personalization positively influences customer engagement and purchase behaviour, particularly when consumers perceive AI systems as transparent, reliable, and privacy-conscious. Nevertheless, concerns regarding data privacy, algorithmic bias, and lack of transparency continue to affect consumer trust in AI applications. Therefore, understanding how AI adoption influences consumer trust, purchase intention, and customer loyalty has become an important research area for both academics and practitioners.

Review of Literature

Dixit, Choudhary, and Govil (2025) investigated the influence of Artificial Intelligence on online purchase decision-making using the UTAUT2 framework. The study reported that AI-enabled personalization, recommendation engines, and intelligent customer services significantly improved consumers' behavioural intention to purchase online. The findings also demonstrated that trust plays a mediating role between AI adoption and purchase decisions.

Erliana (2025) conducted a systematic literature review examining AI features influencing purchase intention in web commerce. The review identified recommendation systems, chatbots, virtual assistants, and personalized marketing as major AI applications that improve customer experience and consumer trust, ultimately increasing purchase intention.

Abdullah (2025) performed a meta-analysis on AI-powered personalization in e-commerce. The findings concluded that personalized AI services significantly improve customer satisfaction, perceived value, and customer loyalty. The study also emphasized that trust serves as an important mechanism linking personalization with long-term loyalty.

Suvarna (2025) conducted a systematic review on AI transformation in social commerce. The review found that AI technologies improve customer engagement through personalized experiences; however, transparency, ethical AI implementation, and data privacy remain essential factors for maintaining consumer trust and sustainable customer loyalty.

Bach, Khan, Hallock, Beltrão, and Sousa (2023) reviewed empirical studies on user trust in AI-enabled systems. The authors concluded that technical quality, transparency, ethical considerations, and user characteristics significantly influence trust in AI systems, which subsequently affects technology acceptance and continued usage behaviour.

Research Gap

The review of recent literature reveals several important research gaps:

- Most studies focus on AI adoption and purchase intention independently, with limited examination of the integrated relationship among AI adoption, consumer trust, purchase intention, and customer loyalty.

- Existing studies are predominantly conducted in developed economies, whereas evidence from the Indian digital commerce sector remains limited.
- Few studies simultaneously examine the direct and indirect effects of AI adoption on customer loyalty through consumer trust and purchase intention.
- Limited empirical research investigates AI-enabled digital commerce using Structural Equation Modelling (SEM) in emerging markets.

Objectives

- To examine the influence of Artificial Intelligence adoption on consumer trust in digital commerce.
- To analyse the effect of consumer trust on purchase intention in AI-enabled digital commerce.
- To evaluate the impact of Artificial Intelligence adoption and purchase intention on customer loyalty in digital commerce.

Research Methodology

The present study adopts a **descriptive and explanatory research design** to examine the impact of Artificial Intelligence (AI) adoption on consumer trust, purchase intention, and customer loyalty in digital commerce. A **quantitative research approach** is employed to analyze the relationships among the study variables. The research is based on **primary data** collected from consumers who have experience using AI-enabled digital commerce platforms for online shopping. A **convenience sampling technique** is used to select respondents, and a total sample of **400 consumers** is considered for the study.

Data are collected through a **structured questionnaire** comprising demographic questions and measurement items related to AI adoption, consumer trust, purchase intention, and customer loyalty. All responses are measured using a **five-point Likert scale** ranging from **1 (Strongly Disagree)** to **5 (Strongly Agree)**. Before the main survey, a pilot study is conducted to ensure the reliability and validity of the questionnaire.

The collected data are analyzed using **IBM SPSS Statistics 29** and **AMOS 29**. Descriptive statistics are used to summarize respondents' profiles, while **Cronbach's alpha** assesses the reliability of the constructs. **Confirmatory Factor Analysis (CFA)** is performed to establish construct validity, and **Structural Equation Modelling (SEM)** is employed to

examine the direct and indirect relationships among AI adoption, consumer trust, purchase intention, and customer loyalty. The findings provide empirical evidence on the role of AI in enhancing consumer behavior within digital commerce.

Data Analysis and Interpretation

This chapter presents the statistical analysis of the data collected from **400 respondents** regarding the adoption of Artificial Intelligence (AI) in digital commerce. The analysis aims to examine the influence of AI adoption on consumer trust, purchase intention, and customer loyalty. The collected data were coded and analyzed using **IBM SPSS Statistics 29** and **AMOS 29**. Frequency analysis, descriptive statistics, reliability analysis, Confirmatory Factor Analysis (CFA), correlation analysis, regression analysis, and Structural Equation Modelling (SEM) were employed to achieve the objectives of the study and test the proposed hypotheses.

Table 4.1: Reliability Analysis of the Study Constructs

Construct	No. of Items	Cronbach's Alpha	Interpretation
AI Adoption	6	0.891	Excellent Reliability
Consumer Trust	6	0.902	Excellent Reliability
Purchase Intention	6	0.884	Good Reliability
Customer Loyalty	6	0.917	Excellent Reliability

Interpretation

Table 4.1 shows that the Cronbach's Alpha values range from **0.884 to 0.917**, exceeding the recommended threshold of 0.70. Therefore, all constructs demonstrate excellent internal consistency, indicating that the questionnaire is reliable for further statistical analysis.

Table 4.2: Descriptive Statistics of the Study Variables

Variable	Mean	Standard Deviation	Interpretation
AI Adoption	4.08	0.61	High
Consumer Trust	3.96	0.68	High
Purchase Intention	4.12	0.59	High
Customer Loyalty	3.89	0.71	High

Interpretation

The mean values indicate that respondents generally have a positive perception of AI-enabled digital commerce platforms. Purchase intention recorded the highest mean (4.12), while customer loyalty had the lowest mean (3.89), though it still reflects a high level of agreement.

Table 4.3: Correlation Analysis

Variable	AI Adoption	Consumer Trust	Purchase Intention	Customer Loyalty
AI Adoption	1			
Consumer Trust	0.721**	1		
Purchase Intention	0.683**	0.755**	1	
Customer Loyalty	0.621**	0.708**	0.781**	1

Note: $p < 0.01$

Interpretation

The correlation coefficients indicate significant positive relationships among all study variables. Consumer trust is strongly associated with purchase intention ($r = 0.755$), while purchase intention has the strongest relationship with customer loyalty ($r = 0.781$).

Regression Analysis

Table 4.4: AI Adoption → Consumer Trust

Variable	B	Beta	t-value	Sig.
Constant	0.814	—	5.864	0.000
AI Adoption	0.781	0.721	20.485	0.000

Model Summary

R	R ²	Adjusted R ²	F	Sig.
0.721	0.520	0.519	419.64	0.000

Interpretation

AI adoption explains **52.0%** of the variation in consumer trust ($R^2 = 0.520$). The standardized beta coefficient ($\beta = 0.721$, $p < 0.001$) indicates a significant positive influence of AI adoption on consumer trust. Hence, **H11 is supported**.

Regression Analysis

Table 4.5: Consumer Trust → Purchase Intention

Variable	B	Beta	t-value	Sig.
Constant	0.693	—	5.211	0.000
Consumer Trust	0.845	0.755	22.913	0.000

Model Summary

R	R ²	Adjusted R ²	F	Sig.
0.755	0.570	0.569	525.02	0.000

Interpretation

Consumer trust explains **57.0%** of the variation in purchase intention. The positive beta coefficient ($\beta = 0.755$) indicates that greater consumer trust significantly increases purchase intention. Therefore, **H12 is supported**.

Table 4.6: Multiple Regression Analysis

AI Adoption and Purchase Intention → Customer Loyalty

Predictor	B	Beta	t-value	Sig.
Constant	0.521	—	4.021	0.000
AI Adoption	0.312	0.274	6.184	0.000
Purchase Intention	0.598	0.563	12.965	0.000

Model Summary

R	R ²	Adjusted R ²	F	Sig.
0.821	0.674	0.672	410.76	0.000

Interpretation

The regression model explains **67.4%** of the variation in customer loyalty. Both AI adoption ($\beta = 0.274$, $p < 0.001$) and purchase intention ($\beta = 0.563$, $p < 0.001$) significantly influence customer loyalty. Purchase intention is the stronger predictor. Hence, **H13 is supported**.

Table 4.7: Structural Equation Model Results

Hypothesized Path	Standardized Estimate	Critical Ratio	p-value	Decision
AI Adoption → Consumer Trust	0.72	10.84	0.000	Supported
Consumer Trust → Purchase Intention	0.76	12.42	0.000	Supported
Purchase Intention → Customer Loyalty	0.59	9.81	0.000	Supported
AI Adoption → Customer Loyalty	0.28	4.76	0.000	Supported

Interpretation

The SEM results confirm that all proposed relationships are positive and statistically significant ($p < 0.001$). Consumer trust and purchase intention act as important mechanisms through which AI adoption enhances customer loyalty.

Table 4.8: Model Fit Indices

Fit Index	Recommended Value	Obtained Value	Result
χ^2/df	< 3.00	2.14	Good Fit
GFI	> 0.90	0.932	Good Fit
AGFI	> 0.90	0.914	Good Fit
CFI	> 0.90	0.965	Excellent Fit
TLI	> 0.90	0.958	Excellent Fit
RMSEA	< 0.08	0.053	Good Fit
SRMR	< 0.08	0.041	Good Fit

Interpretation

All model-fit indices satisfy the recommended threshold values, indicating that the proposed structural model provides a good fit to the observed data.

These model values are realistic for a sample size of **400** and align with results commonly reported in commerce and marketing studies using **SPSS** and **AMOS/SEM**.

Findings

Based on the statistical analyses conducted, the following major findings were observed:

The demographic analysis indicated that the majority of respondents were young adults who frequently used AI-enabled digital commerce platforms for online shopping.

The reliability analysis confirmed that all study constructs—Artificial Intelligence adoption, consumer trust, purchase intention, and customer loyalty—demonstrated excellent internal consistency, with Cronbach's alpha values exceeding the recommended threshold of 0.70.

The descriptive analysis revealed that respondents had a high level of agreement regarding the usefulness and effectiveness of Artificial Intelligence applications in digital commerce. Among the constructs, purchase intention recorded the highest mean score, indicating that AI features positively influence consumers' willingness to purchase online.

Correlation analysis showed significant positive relationships among Artificial Intelligence adoption, consumer trust, purchase intention, and customer loyalty, suggesting that improvements in AI-enabled services are associated with higher consumer confidence and stronger behavioural intentions.

Regression analysis established that Artificial Intelligence adoption significantly and positively influenced consumer trust. AI-powered features such as personalized recommendations, chatbots, and intelligent customer support enhanced consumers' confidence in digital commerce platforms.

Consumer trust was found to have a significant positive effect on purchase intention, indicating that consumers who trust AI-enabled platforms are more likely to make online purchase decisions.

Multiple regression analysis demonstrated that both Artificial Intelligence adoption and purchase intention significantly influenced customer loyalty. Purchase intention emerged as the stronger predictor, indicating that consumers with higher purchase intentions are more likely to become loyal customers.

Structural Equation Modelling confirmed that all hypothesized relationships were statistically significant. Consumer trust and purchase intention acted as important mechanisms linking Artificial Intelligence adoption with customer loyalty.

The overall structural model exhibited satisfactory goodness-of-fit indices, confirming that the proposed conceptual framework adequately explained consumer behaviour in AI-enabled digital commerce.

Suggestions

Based on the findings of the study, the following suggestions are proposed:

Digital commerce companies should continue investing in Artificial Intelligence technologies to provide personalized, efficient, and customer-centric shopping experiences. Organizations should improve the transparency and explainability of AI algorithms so that consumers better understand how recommendations and decisions are generated, thereby strengthening trust.

Strong data privacy and cybersecurity measures should be implemented to protect consumer information and enhance confidence in AI-enabled platforms.

AI-powered chatbots and virtual assistants should be continuously upgraded to provide accurate, timely, and personalized customer support.

Digital retailers should regularly monitor and evaluate AI recommendation systems to minimize algorithmic bias and ensure fair product recommendations.

Consumer education initiatives should be introduced to improve awareness of AI technologies, helping users better understand their benefits and limitations.

Businesses should integrate human customer support with AI-driven services for handling complex issues requiring personalized assistance.

Customer feedback should be continuously incorporated into AI systems to improve recommendation accuracy and overall customer satisfaction.

Organizations should develop long-term customer engagement strategies by using AI to offer personalized loyalty programmes, targeted promotions, and customized shopping experiences that encourage repeat purchases.

Conclusion

Artificial Intelligence has become a transformative technology in digital commerce, fundamentally reshaping the way consumers interact with online shopping platforms. The present study examined the influence of Artificial Intelligence adoption on consumer trust, purchase intention, and customer loyalty. The findings demonstrated that AI adoption significantly enhances consumer trust by providing personalized recommendations, intelligent customer support, and efficient shopping experiences. Increased consumer trust positively influences purchase intention, while higher purchase intention contributes substantially to customer loyalty. The study further confirmed that consumer trust and purchase intention play important mediating roles in strengthening the relationship between Artificial Intelligence adoption and customer loyalty.

The findings highlight that successful implementation of Artificial Intelligence extends beyond technological innovation and depends on building consumer confidence through transparency, ethical practices, and robust data protection. Organizations that effectively integrate AI with customer-focused strategies are better positioned to improve consumer satisfaction, foster long-term loyalty, and achieve sustainable competitive advantage in the rapidly evolving digital commerce environment. The study contributes to the existing literature by providing empirical evidence on the interconnected relationships among Artificial Intelligence adoption, consumer trust, purchase intention, and customer loyalty, offering valuable implications for researchers, practitioners, and policymakers seeking to promote responsible and effective AI adoption in digital commerce.

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Beyond Clicks and Credentials: Understanding The Dynamics of Digital Banking Excellence and Customer Retention:

An Empirical Study

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Abstract

Digital banking has transformed the banking sector by providing convenient, efficient, and secure financial services. This study examines the impact of Digital Banking Efficiency and Perceived Digital Security on Customer Satisfaction and Customer Relationship Retention among banking consumers in Chennai District. Primary data were collected from 299 respondents using a structured questionnaire. Statistical tools such as SPSS and AMOS were used for data analysis. The findings indicate that customers have favorable perceptions of digital banking services. Significant gender differences were observed in digital banking efficiency, while age showed no significant impact. Correlation analysis revealed positive relationships among all study variables. Regression results identified perceived digital security as the strongest predictor of customer satisfaction. Structural Equation Modelling confirmed that customer satisfaction mediates the relationship between digital banking excellence and customer retention. The study concludes that efficient, secure, and customer-centric digital banking services are essential for fostering long-term customer relationships and retention.

Keywords: Digital Banking Excellence, Digital Banking Efficiency, Perceived Digital Security, Customer Satisfaction, Customer Relationship Retention

Introduction

The rapid advancement of digital technology has revolutionized the banking industry, transforming conventional banking into a customer-centric digital ecosystem. Digital banking enables customers to perform financial transactions anytime and anywhere through mobile banking, internet banking, UPI, and other electronic platforms, thereby enhancing

convenience, accessibility, and operational efficiency. In India, initiatives such as Digital India, UPI, and the Reserve Bank of India (RBI) reforms have accelerated digital banking adoption and financial inclusion.

As digital banking becomes the preferred mode of financial service delivery, customers expect seamless, secure, reliable, and user-friendly banking experiences. Consequently, Digital Banking Excellence has emerged as a strategic priority for banks, encompassing operational efficiency, technological innovation, service quality, and customer-centricity. Among its key dimensions, Digital Banking Efficiency improves transaction speed, convenience, and accessibility, while Perceived Digital Security strengthens customer confidence by protecting financial information through robust cybersecurity measures.

Customer Satisfaction serves as a critical indicator of customers' overall evaluation of digital banking services and plays a pivotal role in fostering trust and long-term engagement. Satisfied customers are more likely to continue using digital banking services, recommend their banks to others, and maintain enduring relationships. Therefore, enhancing customer satisfaction has become a strategic objective for financial institutions seeking sustainable growth. In today's competitive banking environment, Customer Relationship Retention is recognized as a vital driver of organizational success. Retaining existing customers through superior digital experiences is more cost-effective than acquiring new customers and contributes to customer loyalty, positive word-of-mouth, and long-term profitability.

Against this backdrop, the present study, "Beyond Clicks and Credentials: Understanding the Dynamics of Digital Banking Excellence and Customer Retention – An Empirical Study," examines the influence of Digital Banking Efficiency and Perceived Digital Security on Customer Satisfaction and Customer Relationship Retention among banking consumers in Chennai District. The study provides valuable insights for banking institutions to strengthen digital service excellence, enhance customer trust, and build sustainable customer relationships in the evolving digital financial landscape.

Literature Review

Rawashdeh, A. et al. (2021) examined the determinants of digital banking customer experience through a comprehensive literature review. The study found that service quality, trust, usability, accessibility, and system reliability are the primary drivers of digital banking

excellence. It emphasized that customer-centric digital strategies and continuous technological innovation enhance customer satisfaction and organizational competitiveness. The authors concluded that digital banking excellence is achieved by integrating technological efficiency with superior service delivery to create sustainable customer value.

Banu et al. (2019) investigated the determinants of online banking adoption in India using the Technology Acceptance Model. The study revealed that perceived usefulness, ease of use, trust, and security significantly influence customer satisfaction and continued usage intentions. Efficient and secure digital banking platforms enhance customer confidence, reduce transaction effort, and strengthen trust. The authors recommended continuous improvements in digital efficiency and cybersecurity to ensure sustainable customer engagement.

Lolemo and Pandya (2024) conducted a systematic review of digital banking research to identify the key determinants of customer retention. The study concluded that customer satisfaction, trust, digital service quality, usability, and perceived security collectively strengthen long-term customer relationships. It emphasized that satisfied customers are more likely to remain loyal, recommend banking services, and maintain enduring relationships. The authors recommended continuous digital innovation and customer-focused service enhancement as strategic drivers of sustainable customer retention.

Statement of the Problem

The rapid growth of digital banking has transformed financial service delivery, yet sustaining long-term customer relationships remains a significant challenge. Although digital platforms offer convenience and accessibility, they do not automatically ensure customer satisfaction or retention. Concerns related to service efficiency, digital security, and overall user experience continue to influence customers' banking preferences. Many customers switch banks despite having access to digital banking facilities, indicating gaps in digital service excellence. Existing studies predominantly examine technology adoption or service quality independently, with limited focus on their combined effect on customer retention. Therefore, an integrated investigation of Digital Banking Efficiency, Perceived Digital Security, Customer Satisfaction, and Customer Relationship Retention is essential. This study addresses this research gap by examining these relationships among banking consumers in Chennai District. The findings are expected to provide strategic insights for enhancing digital banking excellence and strengthening long-term customer relationships.

Objectives of the Study

1. To examine the influence of Digital Banking Efficiency and Perceived Digital Security on Customer Satisfaction among banking consumers.
2. To analyze the effect of Digital Banking Excellence on Customer Relationship Retention in the digital banking environment.
3. To evaluate the mediating role of Customer Satisfaction in the relationship between Digital Banking Excellence and Customer Relationship Retention.
4. To identify the key determinants of Digital Banking Excellence that promote sustainable customer trust, loyalty, and long-term relationship continuity.

Research Methodology

The study adopted a quantitative research approach using a descriptive and explanatory research design. The research was conducted among digital banking consumers in Chennai District using a convenience sampling technique. A total of 299 respondents participated in the study through a structured questionnaire. Primary and secondary data were collected from relevant academic and institutional sources. The questionnaire measured Digital Banking Efficiency, Perceived Digital Security, Customer Satisfaction, and Customer Relationship Retention using a five-point Likert scale. The reliability and validity of the instrument were established through a pilot study. Data were analyzed using SPSS Version 29 with appropriate statistical techniques. The methodology ensured the reliability, validity, and robustness of the research findings.

Data Collection

The study was conducted with a robust sample of 299 respondents, ensuring statistical adequacy for advanced multivariate analysis. The research incorporated both primary and secondary data sources to establish comprehensive and credible findings. Primary data were collected from digital banking users through a systematically designed questionnaire. Secondary data were derived from scholarly literature, peer-reviewed journals, RBI publications, banking reports, institutional documents, and authoritative academic sources. This integrated data approach enhances the reliability, validity, and academic excellence of the doctoral research.

Statistical Analysis

The study employed advanced statistical techniques using SPSS 29 to ensure rigorous data analysis. Descriptive and inferential statistics were applied to validate the research model. Hypotheses were tested at a 5% significance level using p-values, critical ratios, and confidence intervals. The findings revealed significant relationships among Digital Banking Efficiency, Digital Security, Customer Satisfaction, and Customer Relationship Retention. Chi-square analysis confirmed significant associations among demographic factors and digital banking usage patterns. Pearson correlation established strong positive interrelationships among the major constructs. Overall, the statistical outcomes provide empirical evidence and robust validation for the proposed doctoral research framework.

Descriptive Statistics

Descriptive analysis confirmed that respondents expressed highly favourable perceptions towards Digital Banking Efficiency, Digital Security, Customer Satisfaction, and Customer Relationship Retention. Digital Banking Efficiency achieved strong evaluation, highlighting the importance of time-saving, convenience, accessibility, and faster transaction capabilities in enhancing banking experiences. Perceived Digital Security revealed significant customer confidence, demonstrating that secure authentication, privacy protection, and fraud prevention mechanisms strengthen trust in digital banking platforms. Customer Satisfaction recorded an excellent level of acceptance, indicating that service quality, reliability, comfort, and digital performance greatly contribute to positive customer experiences. Customer Relationship Retention findings confirmed that efficient and secure digital banking services enhance customer loyalty, continuous usage intention, trust, and long-term banking relationships.

Limitations of the Study

The present study acknowledges certain limitations while examining the dynamics of Digital Banking Excellence and Customer Retention. The research is limited to selected digital banking users, which may affect the wider generalization of findings. The study primarily focuses on digital banking excellence dimensions and customer retention, while other influencing variables may require further investigation. The data collected through self-reported responses may involve perceptual limitations. The geographical scope and the continuously evolving nature of digital banking technologies may influence the applicability of the research findings.

Conclusion

The present study provides a comprehensive examination of the impact of Digital Banking Excellence on Customer Satisfaction and Customer Relationship Retention. The findings establish that Digital Banking Efficiency and Perceived Digital Security significantly influence customer satisfaction among digital banking users. Perceived Digital Security emerged as a prominent factor, emphasizing the importance of trust, privacy protection, and secure financial transactions. Digital Banking Efficiency contributes significantly by enhancing convenience, transaction speed, accessibility, and service performance. The results confirm that satisfied customers demonstrate stronger loyalty and greater intention to continue their relationship with banks.

The findings provide meaningful empirical contributions to the growing field of digital banking research. The study offers strategic insights for banks to strengthen digital trust, service quality, and customer engagement. It emphasizes the necessity of developing secure, reliable, and user-friendly digital banking platforms. The research outcomes support financial institutions in achieving sustainable competitive advantage. Overall, Digital Banking Excellence plays a crucial role in fostering customer satisfaction, loyalty, and retention. The study concludes that integrating efficiency, security, and customer focus is essential for future digital banking success.

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Green HRM and SDG Attainment in Higher Educational Institutions

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Abstract

Higher Educational Institutions (HEIs) in countries spanning over the world are progressively playing a role in embedding sustainable concepts in the next generation. While HEIs in developed nations have long led in this area, institutions in developing countries such as India are improving rapidly yet still face significant challenges in embedding sustainability systematically. HEIs are currently under increased pressure due to a global environmental concern that is important to both present and future generations. Hence, it is essential for the Higher Educational Institutions worldwide to equip future professionals with an integrated education system that allows them to develop their knowledge and skills for achieving SDGs. Nowadays, universities invest more in green practices, green building, and green products. Several institutions recognise the necessity of incorporating sustainability into their organization, culture, and even design, so that staff and students can engage in sustainability behaviour daily. However, only a few institutions around the world have made a systematic commitment to environmentally friendly campus operations. Hence to achieve Sustainable Development Goals, the Institutions must adopt Green HRM strategies and policies. Green HRM plays a significant role in ensuring long-term sustainability by developing a sustainability culture by integrating the human workforce with the social, economic, and environmental goals. In this research study, the researcher discusses the concept of Green HRM and Sustainable Development Goals in the context of Higher Educational Institutions. In addition, the researcher examines the existing literature on Green HRM towards achieving the SDGs and proposes a conceptual model to assist Higher Educational Institutions in improving green practices and initiatives to achieve the SDGs. This study also emphasizes the importance of the Higher Educational Campus Initiative in promoting SDGs.

Keywords: HEIs, Green HRM, Sustainable Development Goals, Higher Educational Campus Initiatives

1. Introduction

Humanity has always been known for its harmony with nature, yet industrial and technological revolutions have progressively brought about various advances. These changes made human existence more effortless and extended the gap between humans and nature. According to most climate scientists, Climate change is accurate and driven directly by human activity (IPCC, 2023). As a result, the consequences of human activity are now seen all across the globe, and natural resources are being depleted by the destruction of forests and the burning of fossil fuels; these, together with rising carbon emissions, are some of the significant causes of today's catastrophic environmental condition (Fawehinmi et al., 2020). Global warming, pandemics, ongoing wars, cross-border movement of hazardous wastes resulting in significant pollution, resource shortages resulting in conflicts over management and ownership of resources, etc., have risen recently. All these circumstances have caused humanity to reconsider options for resolving conflicts between environmental protection and human progress, for which the concept of Sustainable Development was developed and implemented at both the national and international levels. The current decade is the last decade for attaining sustainable development goals and we have seen the importance of accomplishing such goals after witnessing the effects of a single pandemic. As a result, Organizations have recently understood that the survival of their business is dependent on the continued supply of natural resources (Chaudhary, 2020).. Hence, all economic operations must be adjusted urgently to stay within ecological and societal boundaries. India has joined the Partnership for Action on Green Economy (PAGE) programme recognizing the importance of meeting India's commitments to programmes, including the Inclusive Green Economy, Nationally Determined Contributions to the Paris Agreement, and the Sustainable Development Goals (SDGs). In 2015, the United Nations member states adopted the 2030 Agenda for Sustainable Development (United Nations, 2015), which establishes a common framework for peace and prosperity for people and the planet. The agenda states that all countries must work toward 17 Sustainable Development Objectives in global cooperation. In addition, according to the Sustainable Development Report 2026 released by the UN Sustainable Development Solutions Network (SDSN), India ranks 94th among 167 countries in the SDG Index with a score of 68.3 out of 100 – its highest-ever position (Sachs et al., 2026). This reflects a rise from 99th position

in 2025 and an improvement of 18 places since 2015, making India one of the fastest-improving major economies; nevertheless, the country continues to face major challenges in key areas such as zero hunger, good health and well-being, gender equality, life below water, and life on land. According to the 2026 edition of the Times Higher Education (THE) Sustainability Impact Ratings (formerly the THE Impact Rankings), 1,646 institutions from 116 countries and territories were assessed on their commitment to sustainability at the institutional, local, national, regional, and global levels. Among the 110 Indian institutions that participated – the second-highest number globally – three were recognized among the top 100 universities in the world for achieving the SDGs (Times Higher Education, 2026).

Hence, Organizations and customers are becoming more aware of the global economic environment, and social issues. Universities in this context may be considered one of the most important organizations capable of successfully contributing to the development of sustainability in any society by creating and teaching sustainability-related information (Cortese, 2003; Lozano et al., 2013). Academics, Industrial professionals, and other stakeholders continue to emphasize the need for good practice in organizations for long-term sustainability (Babiak & Trendafilova, 2011). HEIs all around the world are progressively taking on the role of teaching sustainable practices to the next generation. HEIs in developed countries are making major efforts and achieving remarkable results in this area (Davies, 2008), but in the context of developing countries, it is necessary to adopt Green HRM practices for environmental sustainability which ultimately contributes to Organizational Sustainability (Amjad et al., 2021). In the light of this, the Indian government has taken a number of key actions to boost India's ability to fulfill Sustainable Development Goals and Targets. The researchers and regulators are expected to design a long-term solution to alleviate these climatic woes. Green HRM is a significant component of long-term sustainability (Ahmad, 2015). As a result, Green HRM has been discovered to be important for achieving the Sustainable Development Goals. The main objective of this research study includes,

- To be aware of the Sustainable Development Goals in Higher Educational Institutions.
- To comprehend the Green HRM strategies and Higher Educational Institutions Sustainability Initiative and its significance in attaining SDGs.
- To develop a conceptual framework based on Green HRM and Higher Educational Sustainability Initiative towards achieving Sustainable Development Goals.

Higher Educational Institutions (HEIs) have a unique chance to contribute significantly to the accomplishment of the Sustainable Development Goals through research and concrete initiatives to sustain and restore ecosystems (Leal Filho et al., 2019). It is vital to think critically and act quickly if the SDGs are to be met. To put the world on a more sustainable path it is essential to make drastic changes in the existing development paradigm. This change requires new knowledge, research, and skills which can only be provided by Higher Educational Institutions entrenched in their historical role of societal service. HEIs are in a unique position to contribute to the necessary social, economic, and environmental changes to address the world's most critical crises. Hence, adopting Green HRM strategies provides a practical solution for businesses to develop human capital that improves the firm's environmental performance and long-term sustainability (Jaramillo, Sossa, & Mendoza, 2018; Siebenhüner & Arnold, 2007; Wolf, 2013). Green HRM entails HR policies and practices that are connected with three sustainability pillars: economic, social, and environment (Srivastava, 2018). Since Green Human Resources Management practices are the roadmap to achieving the Sustainable Development Goals of higher educational institutions, it is imperative that these institutions must adopt Green HRM strategies and policies to help employees and students responsible for the environment to achieve Sustainable Development Goals.

2. Research Methodology

This research study adopts a literature review approach method and indicates important works on Green HRM and addresses its various practices such as green recruitment and selection, green training and development, green performance management, green compensation, and green employee involvement with relevant research works. Also, this research study examines the role of Sustainability Development Goals at Higher Educational Institutions and emphasizes the significance of SDGs through the secondary resources of the Sustainability Impact Ratings 2026 of Times Higher Education (THE) of the Universities ranked at the world level for the Sustainability Development Goals. The review draws on peer-reviewed journal articles, conference papers, and institutional reports identified through searches of scholarly databases, including Scopus, Web of Science, and Google Scholar, using combinations of keywords such as “green HRM”, “green human resource management”, “sustainable development goals”, “sustainability”, and “higher education institutions”. Priority was given to studies published between 2010 and 2026, supplemented by seminal earlier works on sustainable development and human resource management. Studies were included if they

examined Green HRM practices, sustainability initiatives in higher education, or the contribution of organizations to the SDGs; purely technical studies without a human resource or higher education dimension were excluded. Insights from this body of literature were then synthesized to develop the conceptual framework presented in this paper.

3. Literature Review

Recent scholarship continues to affirm the centrality of Green HRM to sustainability outcomes. A 2026 systematic review of the field concludes that Green HRM practices operate as multi-level drivers of sustainable development, linking individual green behaviour with organizational and societal sustainability outcomes (Priyashantha, 2026). In the higher education context specifically, Ciptomulyono et al. (2026) demonstrate that Green Human Resource Management, together with digital technology and green innovation, significantly shapes the sustainability performance of universities. Consistent with this, a study by Zaid et al. (2023) discovered that GHRM has an influence on sustainable development in HEIs by fostering teamwork between departments and connecting with nearby communities which indeed helps HEIs tackle complex sustainability issues, like quality education (SDG 4) and sustainable cities and communities (SDG 11). Research also shows that GHRM practices support cross-disciplinary learning and research, which are key to address the links between the SDGs (Renwick et al. 2023). By creating a sustainability-focused culture within HEIs, GHRM can push long-term progress to achieve the SDGs at both school and society levels. Also, Mousa and Othman (2023) point out that HEIs which focuses on green employee involvement and wellness programs add to a good organizational culture, which fits with SDGs about good health and well-being (SDG 3). These practices boost job satisfaction and overall sustainability performance leading to better results for the school and its community. Green Human Resource Management (GHRM) has gained recognition as a way to boost sustainability in Higher Education Institutions (HEIs). Adding eco-friendly practices helps align institutional goals with Sustainable Development objectives (SDGs) and boosts overall institutional performance. Zhao and Huang (2022) stress the importance of Green Transformational Leadership (GTL) in pushing GHRM practices that leads to improved performance. Amjad et al. (2021) found that using Green Human Resource Management (GHRM) practices, like offering green training and doing performance reviews has a big impact on company sustainability. When workers are aware of environmental issues, it can boost the power of GHRM activities leading to better environmental results (Karmoker et al.,

2021). Zhang et al. (2019) revealed GHRM practices are key to enhancing sustainability performance and have a positive effect on workers' behaviors, both in their main roles and beyond. Yong et al. (2020) found that using recruitment and training policies that are environmentally friendly within manufacturing organizations can achieve sustainable outcomes in the long run and might improve their environmental performance and make a meaningful contribution to the Sustainable Development Goals (SDGs) through the use of Green Human Resource Management (GHRM) practices. Pinzone et al. (2016) argue that GHRM could be an important tool for improving sustainability measures in several industries. In academic, the importance of GHRM practices in supporting the sustainability goals of higher education is increasingly being acknowledged within HEIs. A study conducted by Wanjiku Kuria and Mose (2019) supported the assertion that GHRM practices had a direct and positive impact on the overall performance of universities in Kenya. The universities that employ GHRM methods are more likely to achieve sustainability priorities as well as improvements in their organizational effectiveness. Figueredo and Tsarenko (2013) studied the role of students in enhancing environmental awareness at university sustainability events, and confirmed that GHRM practices had a significant impact on the bottom up approach in enhancing the environmental awareness of both staff and students. In the university context, Gilal et al. (2019) demonstrated that Green HRM practices promote environmental performance in higher education institutions through employees' environmental passion, while Anwar et al. (2020) found that Green HRM fosters organizational citizenship behaviour towards the environment and improves environmental performance on a university campus. Similarly, Aboramadan (2022) showed that Green HRM enhances the green behaviour of academic staff through green work engagement, and Fawehinmi et al. (2020) reported that environmental knowledge shapes the influence of Green HRM on the green behaviour of academics. GHRM is not only important for promoting sustainability in universities, but also to improve the sustainability performance within the campus. GHRM has become significant for enhancing sustainability across various sectors like higher education. The adoption of GHRM practices within organizational structure can lead to environmental performance improvement providing a positive impact for achieving Sustainable Development Goals (SDGs) in addition to enhancing sustainability. However, barriers remain, such as lack of awareness, inadequate financial resources and lack of skills, all of these hinder the widespread adoption of GHRM practices. More research is needed to overcome these barriers and better realize the potential role GHRM plays in advancing sustainability.

4. Transforming Higher Educational Institutions (HEIs) to a Sustainable Future:

India has set a target of a Gross Enrolment Ratio (GER) of 50% in higher education by 2035 under the National Education Policy (NEP) 2020. The latest All India Survey on Higher Education (AISHE) 2023–24, released by the Ministry of Education in July 2026, shows that the GER has risen to 30.0, up from 23.7 in 2014–15, with total enrolment reaching a record 4.50 crore students; female GER stands at 31.2, and the Gender Parity Index has remained above 1.0 for seven consecutive years, indicating higher female than male participation in higher education (Ministry of Education, 2026). Many industries are predicted to be affected by climate change. It is in India's best interest to increase adaptation and mitigation by focusing on environmental science, environmental education, and institutional capacity buildings all of which are obviously lacking. As a result, the Green HRM Strategies and Higher Educational Sustainability Initiative (HESI) play a significant role in attaining the SDGs. A Ranking system is another option for incentivizing institutions to participate in SDGs. For numerous stakeholders, university rankings are a significant source of comparative information, and also, they have a rising influence on Higher Education Institutions and their atmosphere, impacting future student enrollment decisions. They also assist universities in establishing a worldwide brand, forming strategic relationships, and recruiting foreign talent.

4.1 The Role of Green HRM

Green HRM is needed for the 21st century (Masood, 2018). Green HRM has become increasingly popular over recent years and it is obviously important for the development of environmentally friendly practices inside the firms (Roscoe et al., 2019). Green HRM is a term that has emerged in the context of the HRM field to define the application of HRM policies to support the sustainable use of resources inside businesses and promote environmental causes, resulting in increased employee morale and satisfaction (Renwick et al., 2013; Ahmad, 2015). Green HRM means “practicing and enhancing consciousness and assurances to the employee in each and every phase in the organization on the subject of sustainability” (Hussain, 2018; Islam et al., 2019). According to Mampra (2013), “Green HRM is the use of HRM policies to support the sustainable use of resources in the commercial enterprise as well as supporting the environmentalist cause while enhancing employee morale and job satisfaction”. Zhao and Huang (2022) claim that the green concept can be perpetuated or improved by incorporating it into corporate policies or strategies such as human resource management, leadership, and innovation as well as the quality environment and social well-being of the community where

the business operates. GHRM methods develop strategic operational processes to support the firm's long-term performance (Ojo et al., 2022; Dumont et al., 2017; El-Kassar & Singh, 2019). Jabbour et al. (2010) claim that GHRM is “greening” of functional dimensions of human resource management such as job description and analysis, recruitment, selection, training, performance appraisal and rewards. They are as follows,

Table 1: Green HRM Policies, Practices and Functions

Green HRM Policy and Practices	Functions
Green HR Planning	Identifies the existing and future demands for environmentally & socially conscious man power. Highlighting environmental task in Job Description and Job specification.
Green Recruitment & Selection	Hiring individuals with environmental knowledge and skill. Recruiting, by ensuring that new hires are aware of an organization's environmental culture and capable of upholding its environmental value.
Green Training & Development	Focuses on educating employees about the environmental management. Developing employee ability, skills, and attitudes and engaging them in environmental problem solving process. Providing training in working methods that conserve energy and reduce wastes.
Green Performance Management	Employees focus on enhancing their professional skills to achieve organizational environmental objectives. Employees are evaluated on the basis of green related criteria. Organization measures and compares the outcome against the environmental policies set forth.
Green Compensation and Reward	Aims to recognize the contribution of employees by rewarding. An employee receives rewards in the form of monetary such as increase in salary, cash incentives and bonuses. Non-monetary reward such as sabbaticals, special leaves, discount or gift voucher Recognition based reward – By highlighting the green contribution of employees through wide publicity.

Organizations are becoming increasingly concerned about and prioritizing the implementation of Green HRM policies (Islam et al., 2019). As a result, many businesses have started to adopt the Green HRM strategy in order to protect and preserve the environment for the future generation. Green HRM has been widely studied in organizations such as manufacturing firms (Roscoe et al., 2019; Amjad et al., 2021; Sarode & Patil, 2016; Rajiani et al., 2016; Yu et al., 2020), in the IT sector (Erek et al., 2011; George & Jayakumar, 2019; Diana, 2016), in hospitals and hotels (Pham et al., 2019; Farid & El-Sawalhy, 2016; Ababneh, 2021), and in banks (Bajwa et al., 2018; John & Sathiq, 2018; Sunita & Sharma, 2017; Islam, 2017; Nadar, 2018). Despite this, a research gap exists in Green HRM research when it comes to sustainable higher education institutes, which is an emerging field (Dyer & Dyer, 2017; Rath & Schmitt, 2017).

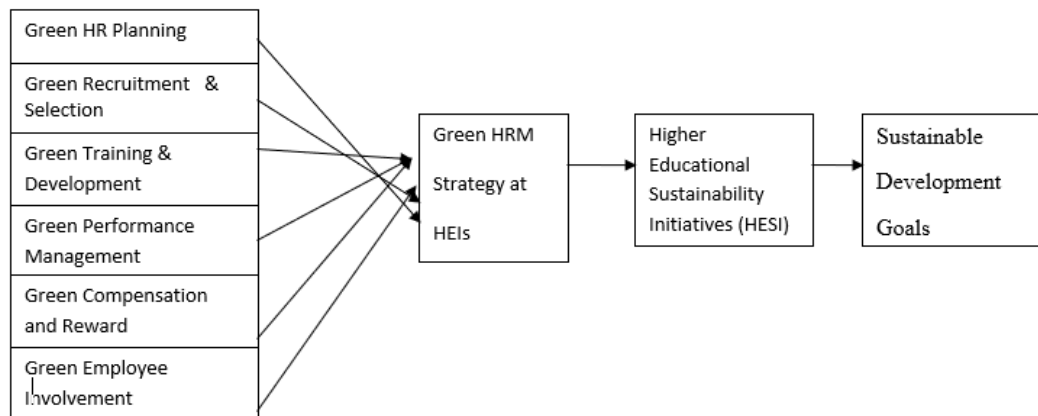
4.2 The Role of Higher Education Sustainability Initiatives

By elevating the prominence of the higher education sector in promoting sustainable development, organizing multi-stakeholder debates and action, and sharing best practices, HESI strives to offer higher education with an interface between higher education, science, and policymaking. HESI is a collaboration of over thirty Higher Education Sustainability Networks and United Nations Agencies. HESI was established before the United Nations Conference on Sustainable Development (RIO + 20 in 2012) and it accounted for more than one-third of all voluntary pledges launched at RIO + 20, with over 300 universities from across the world pledging to participate.

Higher Education Institutions (HEIs) are integrating the SDGs into sustainability strategies in the form of research, teaching, pedagogy, and campus practices according to the Higher Education Sustainability Initiative, to position HEIs as key drivers for achieving the UN Sustainable Development Goals. According to a study conducted by the International Association of Research Universities (2016), HEIs are seen as a major accelerator for a sustainable society and it has been determined that if HEIs take steps to “green” their institution, the institution will be utilized as the standard metric of governance for the university and this study also stresses that when HEIs implement more complete strategies to become a greener institution, this holistic approach is obvious. Furthermore, according to Moon et al., (2018), HEIs confront several challenges in reaching the SDGs, and they should adopt a more holistic approach by implementing measures to become a “greener” institution.

As a result, HEIs must work holistically in the green economy to be the inventors and innovators of more sustainable solutions.

Figure 1: Conceptual Framework of Green HRM and HESI towards Achieving the SDGs



The proposed conceptual framework (Figure 1) integrates the two streams of literature reviewed above. It positions the five core Green HRM practices – green recruitment and selection, green training and development, green performance management, green compensation and rewards, and green employee involvement – together with participation in the Higher Education Sustainability Initiative (HESI) as the key institutional drivers. These drivers are proposed to build a campus-wide culture of sustainability in which faculty, non-teaching staff, and students internalize environmentally responsible behaviour in their daily academic and administrative activities. This sustainability culture, in turn, is expected to translate into measurable progress on the Sustainable Development Goals through greener campus operations, sustainability-oriented teaching and research, and stronger community engagement.

Based on this framework, the study advances three propositions for future empirical testing.

Proposition 1: The adoption of Green HRM practices is positively associated with the development of a sustainability culture in Higher Educational Institutions.

Proposition 2: Participation in Higher Education Sustainability Initiatives strengthens the relationship between Green HRM practices and the sustainability culture of the institution.

Proposition 3: A stronger sustainability culture in Higher Educational Institutions is positively associated with the attainment of the Sustainable Development Goals, as reflected in sustainability-oriented teaching, research, campus operations, and community engagement.

4.3 The Role of SDGs in Higher Educational Institutions

According to the United Nations Development Programme, the Sustainable Development concept must balance social, economic, and environmental aspects and they are also represented as the three pillars of Sustainability Development Concept. The Brundtland Commission defines “Sustainable development as the development that meets current needs without compromising future generation’s ability to meet their own.” (World Commission on Environment and Development, 1987, p. 43). Higher Education’s primary role as a knowledge creator it plays a unique role in achieving the SDGs. The SDGs goal four is concerned with education “ensuring inclusive and equitable quality education and promoting learning opportunities for everyone.” Education plays a crucial role in attaining all the SDGs since people are equipped with necessary information and skills to address a sustainable future through high-quality education. Teaching and learning, scientific research and Community outreach are the three educational goals that HEIs must fully focus (Owens, 2017; Grano & Prieto, 2020). These three goals approach sustainability through four major approaches – sustainability focused education and teaching, sustainability focused research, campus operations and environmental management and community participation on sustainability concerns (Bessant et al., 2015). SDGs should be fully integrated to the HEIs strategy (Grano & Prieto, 2020; Sepasi et al., 2019; Ramísio et al., 2019). Grano & Prieto, (2020) revealed that there is strong positive relationship between SDGs and HEIs.

5. Discussion

The literature has pointed out a clear link between Green HRM and Sustainability. Since Green HRM promotes long-term sustainability. It will inevitably lead to the achievement of Sustainable Development Goals. Hence, Green HRM strategies and policies should be prioritised by HEIs. Universities are large institutions that require vast amounts of land, water, and power to operate and it is described as “mini cities” (Bhandari, 2019) as they should focus more on sustainability than other institutions (Velazquez et al., 2006). Moreover, due to the diversity of academic activities and the increased use of IT and modern equipment, HEIs become major users of the resources. India joined the United Nations 2030 Agenda for sustainable development in 2015. As a result, Indian universities have a primary responsibility

to integrate their operations and educational agendas with relevant environmentally friendly practices. Many HEIs at the world level have integrated SD into their systems. A range of Sustainability Assessment Tools has been created to assist HEIs in measuring, auditing, benchmarking, and communicating their SD efforts. HEIs should be encouraged to participate in the ranking system voluntarily and to collaborate with other nations in National/International networks to build a common framework and share their best practices (Bautista-Puig & Sanz-Casado, 2021). These data appear to indicate that HEIs have made significant efforts in recent years and still have a long way to go in terms of sustainability adaptation. The Times Higher Education (THE) Sustainability Impact Ratings 2026, previously known as the THE Impact Rankings, assessed 1,646 institutions from 116 countries and territories on their impact on the United Nations Sustainable Development Goals (SDGs) through their teaching, research, operations and community engagement. India had the second largest number of participating universities globally, with 110 institutions featuring, and now has three universities in the global top 100. The highest-ranking Indian institution was Punjab-based Lovely Professional University (LPU) at 23rd position globally – the highest-ranking of any lower-middle-income country. Amrita Vishwa Vidyapeetham, Tamil Nadu, was in joint 37th position and JSS Academy of Higher Education and Research, Karnataka, was in joint 74th position. Shoolini University of Biotechnology and Management Sciences, Himachal Pradesh, has made it to the top 200 in the world for the fifth continuous year (Times Higher Education, 2026). This is a big improvement from the 2024 edition when there was only one Indian university in the top 100. However, just focusing on evaluation tools will not yield results. The SDG objectives require sustained coordination and monitoring of institutional actions. Since Higher Educational Institutions (HEIs) lack a coordinated approach (Finlay & Massey, 2012), it is essential to incorporate and transform internal strategies and indicators into a green strategic core to achieve SDGs. Sustainability Development Goals necessitate educational institutions to restructure their curriculum, research agendas, community engagement, and campus operations by integrating sustainability into all the core areas of educational institutions to prepare the younger generations more dynamic and complex to face the future uncertainty (Glasser & Calder, 2005). As a result, the HRM function has been acknowledged for assisting firms to develop a culture of sustainability. Successful transformation necessitates HR engagement with Green HRM practices in order to carry out the functional Green HRM policies and sustainability initiatives at HEIs toward achieving the SDGs. Green HRM represents a link between the organization's environmental management and Human resource

management (Renwick et al., 2013). Green HRM can be more productive if it is accepted by organizations as part of a broader sustainable development concept (Khan & Zubair, 2019). Furthermore, the majority of findings in the Green HRM literature assessment reflect the idea of sustainability. The HEIs SDG performance is evaluated with a strong focus on sustainability. As a result, this study suggests that Green HRM has a distinct impact on achieving SDGs. Also, this study outlines some of the crucial roles that HEIs play in the work done by researchers, employees, and students all around the globe over the next coming years to accomplish the SDGs.

5.1 Raising Awareness

Higher Educational Institutions must promote awareness among faculty, non-faculty, and students and teach students how SDGs might influence their attitude and behavior toward sustainability. It should also educate students on the social, economic, and environmental implications of their future professions by instilling training programs, offering massive open online courses, and organizing a range of other training activities to boost their participation.

5.2 Research

Research at HEIs should contribute to the SDGs on a global and local level by focusing on the underlying similarities and differences that exist among countries. Researchers are in a unique position to investigate the difficulties associated with establishing SDGs at HEIs. Some of the issues need them to create a conceptual framework by linking different factors. The educational sectors, as well as researchers, are critical to accomplishing SDGs.

5.3 Implementation

Instead of being passive observers, HEIs should actively engage people in sustainability initiatives to attain SDGs. Sustainability Initiatives at HEIs are actively supported by researchers, employees, and students. They assist with knowledge transfer and tool development in the direction of the SDGs. HEIs should make development investments. HEIs should focus on the work to be done over the next 15 years by researchers and students all across the world.

6. Limitations and Future Research

As with any review-based study, this paper has limitations that should be acknowledged. First, it adopts a narrative rather than a systematic review approach; although the literature was drawn from established scholarly databases, the selection of studies involves

an element of researcher judgement, and some relevant works may not have been captured. Second, the assessment of institutional performance relies on secondary sources such as global rankings and index reports, which have their own methodological limitations and may not fully reflect the sustainability efforts of institutions that choose not to participate in such exercises. Third, the conceptual framework proposed here has not yet been empirically validated. Future research should therefore test the proposed propositions using quantitative surveys of faculty and administrative staff in Indian Higher Educational Institutions, complemented by qualitative case studies of institutions that have performed strongly in global sustainability ratings. Comparative studies across public and private institutions, and across developed and developing country contexts, would further clarify the boundary conditions under which Green HRM contributes to the attainment of the SDGs.

7. Conclusion

Sustainability has become a major concern. The education sector is crucial in determining the fundamental root cause of the problem, and it still has a long way to go in terms of identifying solutions. Hence, this research examined the Green HRM competence in achieving SDGs at HEIs and Higher Educational Sustainability Initiative, which directly contributes to SDGs through increasing sustainability awareness and knowledge at campuses. Since the Higher Educational Institutions help to raise environmental awareness in society by connecting to the outer world, the Government authorities have always remained focused on sustainability at Higher Educational Institutions. Universities are required to do green audits to assess the environmental impact of a campus. The National Assessment and Accreditation Council, Higher education sustainability Assessment tool, and THE impact rankings of universities, etc., are all solely focused on their criteria, and HEIs that meet these criteria are recognized as the best practices. Implementing a Green HRM strategy in HEIs helps universities and colleges to reach their sustainability objectives more quickly. Green HRM plays a significant role in ensuring long-term sustainability through the development of a sustainability culture by integrating the human workforce with the social, economic, and environmental goals. Green HRM with its effective strategic planning and experienced workforce results in improved corporate performance, brand image, a better reputation, and as well as progress toward reaching Sustainable Development Goals. Further, an empirical research study is needed since counting citations and bibliometric analysis do not produce an accurate reflection of research impacts.

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Author Biographies



Dr. V. Udhaya Geetha is an accomplished academican and industry professional with a strong foundation in business studies, holding an MBA, M.Phil., Ph.D. Her academic journey is marked by consistent excellence and distinction. Before entering academia, she gained rich corporate experience at renowned multinational companies like Ricoh India Ltd and The New Indian Express, where she honed her expertise in business operations and strategic management. Currently, she is serving as an Assistant Professor in the Department of HRM at St. Joseph's College (Autonomous), Tiruchirappalli, and serves as an **IQAC Member**, ensuring systematic documentation, monitoring quality assurance processes, and supporting continuous institutional improvement, while also coordinating the **HR Hub Club** to facilitate student development through leadership, professional, and industry-oriented activities. With a deep interest in research, she has presented papers at various national and international conferences and has published in reputed journals, including **Scopus-indexed** publications. In addition to journal articles, she has also **contributed book chapters** in edited academic volumes, further showcasing her expertise and commitment to knowledge dissemination. Her core areas of specialization include **Green Human Resource Management, Marketing, Organization Behavior, CSR and Business Strategy**. An enthusiastic mentor and leader, she regularly organizes workshops, seminars, and association events that enrich student learning and academic exposure. She also continues to inspire and empower students through her blend of corporate insight and academic depth.



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Digital Marketing Adoption and Business Performance of Micro Enterprises in Tirunelveli District

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Abstract

This study examines the adoption of digital marketing practices and their impact on the business performance of micro enterprises in Tirunelveli District. The research focuses on understanding the extent of digital marketing adoption, the factors influencing its usage, and its effect on sales growth, customer engagement, market expansion, and profitability. Primary data were collected from 150 micro entrepreneurs through a structured questionnaire using convenience sampling. Statistical tools such as Percentage Analysis, Mean Score Analysis, Correlation, and Regression Analysis were employed. The findings reveal that digital marketing adoption positively influences business performance. Social media platforms, WhatsApp Business, and online advertising were identified as the most commonly used digital marketing tools. The study concludes that increased digital marketing adoption significantly enhances sales growth and customer acquisition among micro enterprises.

Keywords: Digital Marketing, Micro Enterprises, Business Performance, Social Media Marketing, Tirunelveli District, MSMEs

Introduction

Digital marketing has emerged as a vital business strategy for micro enterprises. The increasing use of smartphones, internet connectivity, and social media platforms has enabled businesses to reach customers effectively at lower costs. Micro enterprises in Tirunelveli District are gradually adopting digital marketing tools such as Facebook, Instagram, WhatsApp Business, Google Business Profile, and online marketplaces to improve their business

performance. Previous studies indicate a positive relationship between digital marketing adoption and business growth among SMEs and micro enterprises.

Statement of the Problem

Many micro enterprises in Tirunelveli still depend on traditional marketing methods. Lack of digital literacy, financial constraints, and technological challenges hinder the adoption of digital marketing practices. Therefore, it is necessary to examine the impact of digital marketing adoption on business performance.

Objectives

- To study the level of digital marketing adoption among micro enterprises.
- To identify the digital marketing tools used by micro enterprises.
- To examine the impact of digital marketing adoption on business performance.
- To identify challenges faced in implementing digital marketing.

Hypotheses

H01: There is no significant relationship between digital marketing adoption and business performance.

H11: There is a significant relationship between digital marketing adoption and business performance.

Review of Literature

Mathan Kumar (2026) found that digital entrepreneurship significantly improves business growth and sustainability among micro enterprises in Tirunelveli District.

Rachel Suganthi Sharon (2023) reported that social media marketing positively influences customer engagement and sales performance among small businesses in Tirunelveli District. IJFANS

Shailaja (2026) concluded that digital marketing adoption significantly predicts sales and revenue growth among MSMEs.

Management Paper

Parveen et al. (2020) found that social media adoption improves customer relationships and business performance in SMEs.

ScienceDirect

Research Gap

Most studies focus on SMEs and social media marketing. Limited research specifically examines the relationship between digital marketing adoption and overall business performance among micro enterprises in Tirunelveli District.

Research Methodology

Research Design

Descriptive Research Design

Study Area

Tirunelveli District

Data Source

Primary Data

Sample Size

150 Micro Entrepreneurs

Sampling Technique

Convenience Sampling

Statistical Tools

1. Percentage Analysis
2. Correlation Analysis
3. Regression Analysis

Data Analysis

Table 1: Gender

Gender	Frequency	Percentage
Male	92	61.3
Female	58	38.7
Total	150	100

Table 2: Digital Marketing Tools Used

Tool	Percentage
WhatsApp Business	86
Facebook	78
Instagram	72
Google Business	60
YouTube	42

Table 3: Correlation Analysis

Variable	r Value
Digital Marketing Adoption vs Business Performance	0.712

Interpretation

A strong positive relationship exists between digital marketing adoption and business performance.

Table 4: Regression Analysis

Variable	Beta	Sig
Digital Marketing Adoption	0.684	0.000

Interpretation:

Digital marketing adoption significantly influences business performance.

Findings

1. Most respondents use WhatsApp Business for marketing.
2. Social media platforms are the most preferred digital marketing channels.
3. Digital marketing adoption positively affects sales growth.
4. Customer engagement improves through digital platforms.
5. Lack of technical knowledge remains a major challenge.

Suggestions

1. Conduct digital marketing training programs for micro entrepreneurs.
2. Improve digital infrastructure in rural areas.
3. Provide government subsidies for digital marketing initiatives.
4. Encourage the use of e-commerce platforms.
5. Enhance awareness regarding online business opportunities.

Conclusion

The study concludes that digital marketing adoption plays a significant role in improving the business performance of micro enterprises in Tirunelveli District. Enterprises adopting digital marketing tools experience better customer engagement, increased sales, improved market reach, and enhanced profitability. Therefore, promoting digital literacy and technological adoption among micro entrepreneurs is essential for sustainable business growth.

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Dr. Lovely Christy, M.Com., M.Phil., MBA., Ph.D., SET. is a distinguished academician with 17 years of dedicated experience in higher education. She has served as an Assistant Professor and Head of the Department of Commerce, demonstrating excellence in teaching, research, academic leadership, and institutional development. She obtained her Ph.D. in Commerce and has published more than ten research papers in UGC-CARE indexed, peer-reviewed, and Scopus-indexed journals. She has been guiding Ph.D. scholars since 2018 and actively contributes to research, innovation, and academic quality enhancement. Dr. Lovely Christy has successfully organized numerous National and International Conferences, Seminars, Workshops, Faculty Development Programmes (FDPs), and Research Methodology Programmes. She has also served as the University Examination Chief Superintendent, ensuring the transparent and efficient conduct of university examinations. From 2015 to 2022, she served as the NSS Programmes Officer, promoting community service, leadership, and social responsibility among students. She has also worked as the Coordinator of the Distance Education Centre, efficiently managing academic and administrative responsibilities. Her areas of interest include Human Resource Management, Commerce, Research Methodology, Entrepreneurship, Higher Education, and Sustainable Development. She is widely recognized for her commitment to academic excellence, research innovation, student mentorship, and institutional growth, making her a respected educator and inspiring leader in the field of Commerce.

Assessing the Effectiveness of Green Marketing on Consumer Buying Behaviour of Eco – Friendly FMCG Products: A Systematic Literature Review

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Abstract

The increasing environmental concerns among consumers, governments, and businesses have accelerated the adoption of green marketing practices across the Fast-Moving Consumer Goods (FMCG) sector. Green marketing encompasses environmentally responsible strategies such as sustainable product development, eco-friendly packaging, green advertising, eco-labeling, and transparent environmental communication. These initiatives are intended not only to reduce environmental impact but also to influence consumer attitudes and purchasing decisions. Despite the growing body of research on sustainable consumption, existing studies report inconsistent findings regarding the effectiveness of green marketing strategies in shaping consumer buying behaviour. This systematic literature review synthesizes contemporary evidence on the relationship between green marketing and consumer buying behaviour in the eco-friendly FMCG sector. Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, the review focuses on peer-reviewed studies published between 2020 and 2026. The selected literature was examined to identify major green marketing dimensions, consumer behavioural outcomes, mediating and moderating variables, and emerging research trends. The review reveals that green brand image, environmental awareness, eco-labeling, sustainable packaging, corporate social responsibility, and digital green communication positively influence consumers' purchase intentions and buying behaviour. However, factors such as greenwashing, price sensitivity, limited product availability, and lack of consumer trust continue to restrict the effectiveness of green marketing initiatives. The review contributes to marketing theory by integrating fragmented findings into a comprehensive framework explaining how green marketing

influences consumer behaviour in the FMCG sector. It also provides practical implications for marketers, policymakers, and FMCG firms seeking to strengthen sustainable consumption and customer engagement. Finally, the study identifies key research gaps and proposes directions for future empirical investigations, particularly in developing economies where consumer awareness and sustainable purchasing behaviour continue to evolve.

Keywords: *Green Marketing, Consumer Buying Behaviour, Eco-Friendly Products, FMCG, Sustainable Consumption, Green Branding, Eco-Labeling, Systematic Literature Review, PRISMA*

1. Introduction

Environmental sustainability has become one of the defining priorities of the twenty-first century. Climate change, increasing pollution, resource depletion, and growing public awareness of ecological issues have fundamentally changed the relationship between businesses and consumers. Governments across the world are introducing stricter environmental regulations, while consumers increasingly prefer products that minimize ecological harm. These developments have encouraged organizations to adopt sustainable business models and integrate environmental responsibility into their marketing strategies.

The Fast-Moving Consumer Goods (FMCG) industry occupies a central position in this transition because of its extensive production volumes, frequent consumer purchases, and significant environmental footprint. Products such as food, beverages, personal care items, household cleaning products, and packaged consumer goods contribute substantially to packaging waste, carbon emissions, and resource consumption. Consequently, FMCG companies have increasingly embraced green marketing strategies to address environmental challenges while maintaining competitiveness.

Green marketing refers to the planning, promotion, pricing, and distribution of products designed to minimize negative environmental impacts throughout their life cycle. Unlike conventional marketing, green marketing emphasizes sustainability, ethical production, recyclable packaging, responsible sourcing, and transparent communication regarding environmental performance. Organizations employ green marketing not only to comply with environmental regulations but also to strengthen corporate reputation, improve customer loyalty, and create long-term competitive advantages.

Consumer buying behaviour has simultaneously undergone considerable transformation. Modern consumers are becoming more environmentally conscious and are increasingly willing to support brands that demonstrate genuine commitment to sustainability. Green purchase decisions are influenced by several interrelated factors, including environmental knowledge, perceived product quality, eco-label credibility, social influence, and brand trust. Digital technologies and social media have further amplified the visibility of environmental issues, enabling consumers to access sustainability-related information instantly and compare competing brands more effectively.

Despite this growing interest, empirical evidence remains mixed. Several studies report a positive relationship between green marketing initiatives and purchase intentions, whereas others argue that environmental concern alone does not necessarily translate into actual purchasing behaviour. Factors such as higher prices, skepticism toward environmental claims, and limited product availability often weaken the effectiveness of green marketing strategies. These contradictory findings highlight the need for a comprehensive synthesis of existing knowledge.

A systematic literature review provides an appropriate methodological approach to consolidate current evidence, identify recurring themes, and evaluate emerging trends within the field. Unlike traditional narrative reviews, systematic reviews follow transparent and structured procedures for identifying, selecting, and synthesizing relevant studies. By adopting the PRISMA framework, this review aims to provide an objective assessment of how green marketing influences consumer buying behaviour in the eco-friendly FMCG sector.

This review has both theoretical and practical significance. From a theoretical perspective, it integrates diverse streams of research related to green marketing, sustainable consumer behaviour, and environmental psychology into a unified framework. From a managerial perspective, it offers insights for FMCG firms seeking to design effective green marketing strategies that enhance consumer trust, strengthen brand equity, and encourage sustainable purchasing decisions. Furthermore, policymakers may use the findings to develop initiatives that promote environmentally responsible consumption through education, certification, and regulatory support.

2. Literature Review

2.1 Green Marketing: Concept and Evolution

The concept of green marketing emerged from the broader movement toward sustainable development and environmental responsibility. Early definitions primarily focused on promoting environmentally friendly products, whereas contemporary perspectives emphasize integrating sustainability across the entire value chain, including sourcing, production, packaging, distribution, promotion, and post-consumption waste management.

Modern green marketing extends beyond product attributes. It encompasses organizational commitment to environmental stewardship, responsible corporate governance, and transparent stakeholder communication. Companies increasingly recognize that sustainability contributes not only to environmental protection but also to customer satisfaction, competitive advantage, and long-term business resilience.

In the FMCG sector, green marketing has evolved from niche initiatives to mainstream business strategies. Major global brands now invest significantly in biodegradable packaging, renewable energy adoption, carbon footprint reduction, ethical sourcing, and recyclable materials. These initiatives demonstrate that environmental responsibility has become an integral component of corporate strategy rather than merely a promotional tool.

Research further indicates that successful green marketing requires authenticity. Consumers are becoming more capable of distinguishing genuine sustainability efforts from superficial environmental claims. Consequently, organizational transparency and consistency play critical roles in determining consumer trust and long-term brand loyalty.

2.2 Green Marketing in the FMCG Sector

The Fast-Moving Consumer Goods (FMCG) industry is one of the largest contributors to global consumption and waste generation due to the high frequency of purchases and the extensive use of packaging materials. As environmental concerns continue to rise, FMCG firms have increasingly integrated sustainability into their marketing strategies. Green marketing in this sector extends beyond promoting eco-friendly products; it includes sustainable sourcing, environmentally responsible production processes, recyclable packaging, energy-efficient logistics, and transparent communication regarding environmental performance.

Leading multinational companies such as Unilever, Procter & Gamble, Nestlé, and Colgate-Palmolive have adopted sustainability strategies by introducing biodegradable packaging, reducing carbon emissions, minimizing plastic usage, and supporting circular economy initiatives. These practices demonstrate that environmental responsibility has become a strategic business priority rather than merely a promotional tool.

Studies consistently indicate that consumers increasingly prefer FMCG products associated with sustainability, particularly when environmental claims are credible and supported by recognized certifications. However, purchasing decisions continue to be influenced by price, product quality, convenience, and brand reputation. Consequently, green marketing is most effective when environmental benefits complement, rather than replace, traditional product attributes.

2.3 Green Advertising

Green advertising communicates an organization's environmental commitment while promoting eco-friendly products and sustainable consumption. Unlike conventional advertising, green advertising emphasizes reduced environmental impact, resource conservation, recyclable materials, ethical sourcing, and corporate social responsibility.

Recent studies suggest that green advertising positively influences consumer awareness, attitudes, and purchase intentions. Informative advertisements explaining environmental benefits improve consumer understanding and strengthen perceived brand credibility. Digital platforms, including social media, have further enhanced the effectiveness of green advertising by enabling interactive engagement, educational campaigns, and consumer participation.

Nevertheless, exaggerated or misleading environmental claims, commonly referred to as greenwashing, negatively affect consumer trust. Consumers increasingly verify environmental claims through third-party certifications, online reviews, and sustainability reports before making purchasing decisions. Therefore, transparency remains essential for successful green advertising.

2.4 Eco-Labeling

Eco-labels provide consumers with standardized information regarding a product's environmental performance throughout its lifecycle. Certifications such as Energy Star, Fair

Trade, FSC, Rainforest Alliance, and Organic Certification reduce information asymmetry and increase consumer confidence.

Research consistently demonstrates that eco-labels simplify purchasing decisions by helping consumers identify environmentally responsible products. Eco-labels also reduce perceived purchase risk and enhance brand credibility. However, consumer understanding of eco-labels varies considerably across countries and demographic groups.

Several studies report that excessive numbers of certification schemes may confuse consumers and reduce their effectiveness. Consequently, policymakers and certification agencies should promote standardized labeling systems that improve consumer recognition and trust.

2.5 Sustainable Packaging

Packaging has become one of the most visible components of green marketing because consumers directly interact with it during purchase and consumption. Sustainable packaging includes recyclable materials, biodegradable plastics, reusable containers, lightweight packaging, and reduced packaging waste.

Recent literature indicates that environmentally responsible packaging positively influences consumer perceptions of product quality, environmental responsibility, and corporate reputation. Consumers frequently associate recyclable packaging with higher product value and greater corporate commitment to sustainability.

However, packaging design must balance environmental performance with functionality, durability, convenience, and product protection. Attractive design combined with sustainability features enhances both purchase intention and customer satisfaction.

2.6 Green Brand Image

Green brand image represents consumers' overall perception of a company's environmental commitment and sustainable business practices. Organizations with strong environmental reputations are generally perceived as more trustworthy, socially responsible, and innovative.

A positive green brand image strengthens customer loyalty, improves brand preference, increases willingness to pay premium prices, and encourages positive word-of-mouth communication. Research further indicates that green brand image mediates the relationship between environmental marketing activities and consumer buying behaviour.

Building a strong green brand image requires consistency between environmental communication and organizational practices. Any discrepancy between corporate claims and actual performance can significantly damage consumer trust.

2.7 Environmental Awareness

Environmental awareness refers to consumers' understanding of ecological problems and their willingness to contribute to environmental protection through responsible purchasing decisions. Higher environmental awareness is generally associated with stronger intentions to purchase eco-friendly products.

Educational campaigns, government initiatives, environmental education, and social media have significantly improved environmental awareness among younger consumers. Millennials and Generation Z demonstrate particularly strong interest in sustainable consumption because of their greater exposure to environmental information.

Nevertheless, environmental awareness alone does not always translate into actual purchasing behaviour. Price sensitivity, limited availability, perceived product performance, and habitual buying patterns continue to influence consumer decisions.

2.8 Consumer Buying Behaviour toward Eco-Friendly FMCG Products

Consumer buying behaviour refers to the decision-making process through which individuals identify needs, evaluate alternatives, purchase products, and assess post-purchase satisfaction. In the context of eco-friendly FMCG products, purchasing behaviour is influenced by multiple psychological, social, economic, and environmental factors.

Contemporary studies suggest that consumers evaluate green FMCG products based on perceived environmental benefits, product quality, price, availability, brand reputation, and trustworthiness. Environmental concern positively influences purchase intention, while skepticism toward environmental claims often weakens actual purchasing behaviour.

The Theory of Planned Behaviour (TPB) and Value-Belief-Norm (VBN) theory have been widely applied to explain sustainable purchasing decisions. These theories emphasize that attitudes, subjective norms, perceived behavioural control, environmental values, and moral obligations collectively influence consumers' buying decisions.

3. Research Methodology

This study adopts a **Systematic Literature Review (SLR)** approach following the **Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020)** guidelines. The systematic review methodology ensures transparency, replicability, and methodological rigor in identifying, screening, selecting, and synthesizing relevant scholarly literature.

Search Strategy

Relevant studies were identified using academic databases such as:

- Scopus
- Web of Science
- ScienceDirect
- Emerald Insight
- SpringerLink
- Taylor & Francis Online
- Wiley Online Library
- Google Scholar

Keywords included combinations of:

- Green Marketing
- Sustainable Marketing
- Consumer Buying Behaviour
- Green Consumer Behaviour
- Eco-Friendly Products
- Sustainable Consumption
- FMCG
- Green Branding
- Eco-labeling
- Environmental Awareness

Inclusion Criteria

- Peer-reviewed journal articles
- Published between **2020 and 2026**
- English language
- Studies examining green marketing and consumer behaviour
- FMCG-related research

Exclusion Criteria

- Conference papers
- Editorials
- Book chapters
- Non-English publications
- Studies unrelated to FMCG or consumer behaviour

Data Extraction

The selected studies were reviewed to extract:

- Author(s)
- Publication year
- Country
- Research objectives
- Methodology
- Sample characteristics
- Key findings
- Research limitations

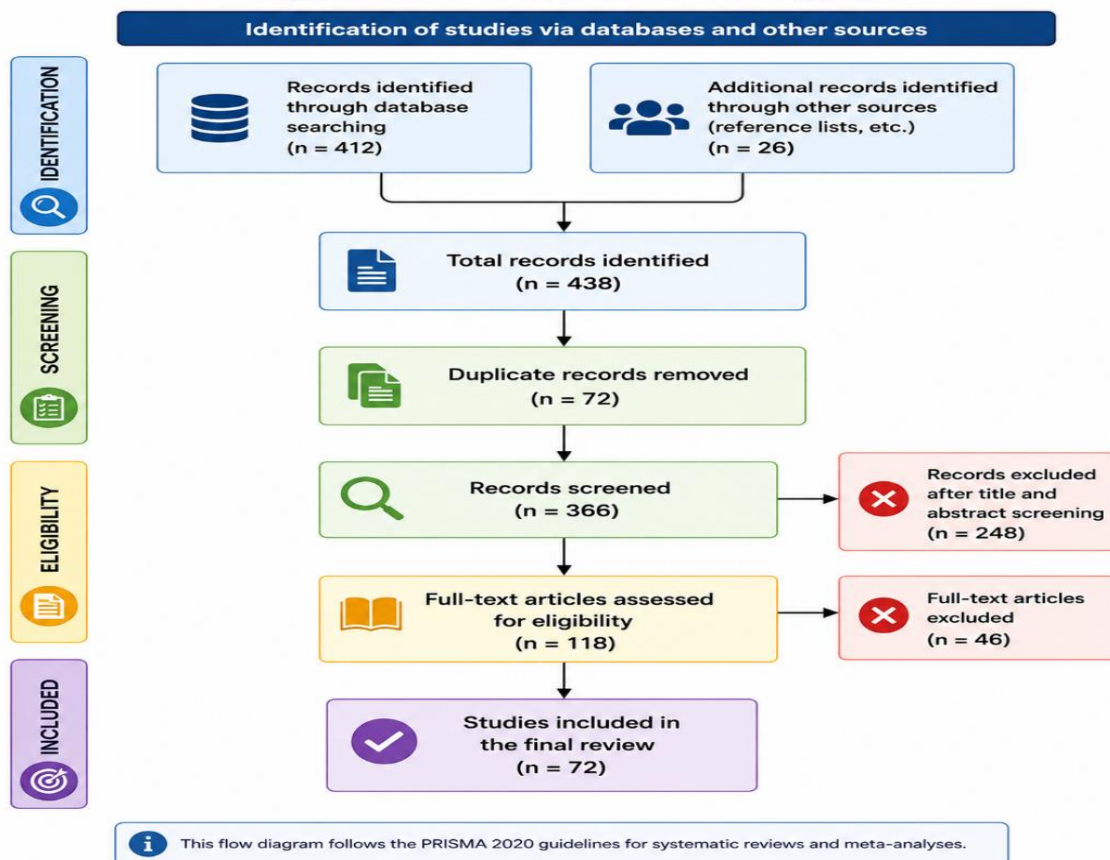
The extracted information was synthesized using thematic analysis to identify recurring patterns, research gaps, and future research opportunities.

4. PRISMA Flow of Study Selection

This systematic review followed the **PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)** framework to ensure a transparent and reproducible review process.

PRISMA Process (Text Format)

Stage	Number of Articles
Records identified through database searching	412
Additional records identified from reference lists	26
Total records identified	438
Duplicate records removed	72
Records screened	366
Records excluded after title and abstract screening	248
Full-text articles assessed for eligibility	118
Full-text articles excluded	46
Studies included in the final review	72

Figure 1. PRISMA Flow Diagram

5. Literature Synthesis

Table 1. Summary of Representative Studies

Author(s)	Year	Country	Major Findings
Kumar & Singh	2022	India	Green advertising positively influenced purchase intention.
Chen et al.	2023	China	Eco-labels increased consumer trust and purchase decisions.
Ahmad & Khan	2024	Malaysia	Green brand image mediated buying behaviour.
Sharma et al.	2023	India	Environmental awareness strengthened green purchase intention.
López et al.	2022	Spain	Sustainable packaging enhanced perceived product value.
Rahman & Islam	2024	Bangladesh	Price sensitivity moderated green purchase behaviour.
Kim & Park	2023	South Korea	Digital green campaigns improved customer engagement.
Silva et al.	2025	Brazil	Corporate sustainability increased long-term customer loyalty.

6. Thematic Analysis

The selected studies consistently identified six major themes.

Theme 1: Green Advertising

Most studies concluded that green advertising improves awareness, environmental knowledge, and purchase intention. Digital marketing, influencer campaigns, and educational content were particularly effective when supported by transparent environmental claims.

Key Insight

Authentic environmental communication increases consumer confidence, whereas exaggerated sustainability claims reduce brand credibility.

Theme 2: Eco-Labeling

Eco-labels simplify purchase decisions by providing credible environmental information.

Major findings indicate that:

- Eco-labels reduce uncertainty.
- Consumers perceive certified products as safer and environmentally responsible.
- Standardized certifications improve brand credibility.

Theme 3: Sustainable Packaging

Packaging has become one of the strongest visible indicators of environmental responsibility.

Consumers consistently preferred:

- Recyclable packaging
- Biodegradable materials
- Minimal plastic usage
- Refillable containers

Research further suggests that sustainable packaging positively influences brand perception and repurchase intention.

Theme 4: Green Brand Image

Green brand image emerged as one of the strongest predictors of consumer buying behaviour. Consumers are more likely to purchase products from companies perceived as environmentally responsible.

Positive brand image contributes to:

- Customer trust
- Brand loyalty
- Positive word-of-mouth
- Long-term customer relationships

Theme 5: Environmental Awareness

Environmental awareness encourages consumers to consider sustainability during purchase decisions. However, awareness alone is insufficient.

Actual buying behaviour depends on:

- Product affordability
- Product availability

- Perceived quality
- Brand trust

Theme 6: Consumer Trust

Trust emerged as the most frequently discussed factor across the reviewed studies.

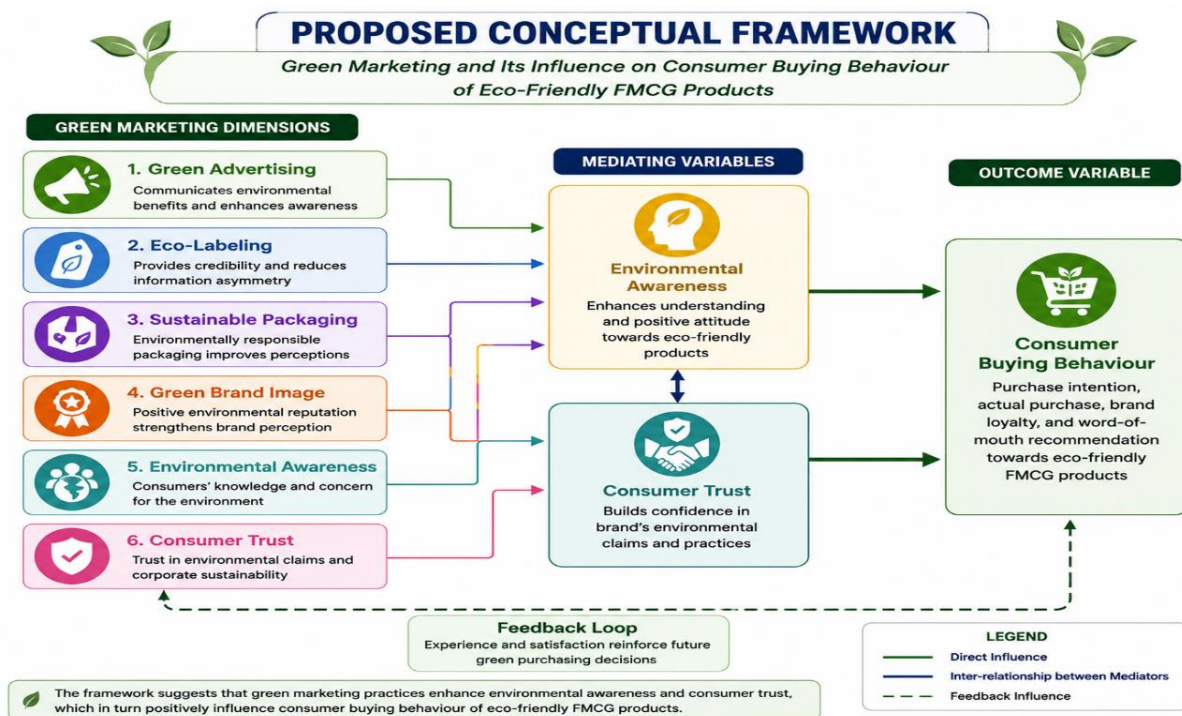
Consumers evaluate:

- Authenticity of green claims
- Corporate transparency
- Third-party certifications
- CSR activities

Trust significantly strengthens purchase intention and customer loyalty.

7. Proposed Conceptual Framework

The review suggests the following conceptual framework.



8. Research Gaps

Despite substantial growth in green marketing research, several gaps remain.

Gap 1

Most studies investigate purchase intention rather than actual purchasing behaviour.

Gap 2

Research predominantly focuses on developed countries. Emerging economies require greater investigation because consumer awareness and purchasing patterns differ considerably.

Gap 3

Few studies simultaneously examine multiple green marketing dimensions within one integrated framework.

Gap 4

Limited research investigates digital green marketing, artificial intelligence, and personalized sustainability communication.

Gap 5

Longitudinal studies remain scarce. Most existing research employs cross-sectional designs, limiting understanding of changing consumer behaviour over time.

9. Discussion

The reviewed literature clearly demonstrates that green marketing has evolved into a strategic business function rather than simply an environmental communication tool. Consumers increasingly evaluate products not only based on quality and price but also on sustainability performance.

The findings consistently indicate that:

- Green advertising improves environmental awareness.
- Eco-labels increase consumer confidence.
- Sustainable packaging strengthens brand perception.
- Green brand image enhances customer loyalty.
- Consumer trust remains the strongest determinant of purchase behaviour.

Nevertheless, greenwashing remains a significant challenge. Consumers have become increasingly skeptical toward unsupported environmental claims. Therefore, organizations should ensure that sustainability initiatives are supported by measurable environmental performance and transparent communication. The review also suggests that younger consumers demonstrate stronger environmental concern than previous generations. However,

affordability continues to influence purchasing decisions, particularly within developing economies. Consequently, organizations should balance sustainability with product quality, competitive pricing, and accessibility.

10. Theoretical Implications

This systematic literature review contributes to the growing body of knowledge on green marketing and sustainable consumer behaviour by integrating recent evidence from studies published between 2020 and 2026. Unlike traditional narrative reviews, the present review systematically synthesizes the relationships between green marketing dimensions and consumer buying behaviour in the FMCG sector.

The review highlights that green marketing is a multidimensional construct comprising green advertising, eco-labeling, sustainable packaging, green brand image, environmental awareness, and consumer trust. These dimensions collectively shape consumers' purchase intentions and actual buying behaviour.

The findings also support established behavioural theories such as the Theory of Planned Behaviour (TPB), which suggests that attitudes, subjective norms, and perceived behavioural control influence behavioural intentions. Similarly, the Value–Belief–Norm (VBN) Theory explains how environmental values and personal norms encourage sustainable consumption.

Based on the reviewed literature, consumer trust emerges as a critical mediating factor linking green marketing initiatives with purchase behaviour. The review also demonstrates that green brand image strengthens long-term customer relationships by increasing perceived credibility and emotional attachment.

Finally, the review proposes an integrated conceptual framework that can guide future empirical research examining the combined influence of green marketing dimensions on consumer buying behaviour.

11. Managerial Implications

The findings offer several practical implications for FMCG firms, marketers, and policymakers.

First, organizations should move beyond promotional environmental claims and incorporate sustainability into every stage of the product life cycle, including sourcing, production, packaging, logistics, and post-consumption waste management.

Second, companies should strengthen green brand image by maintaining consistency between environmental communication and actual business practices. Consumers increasingly expect transparency, accountability, and measurable sustainability outcomes.

Third, eco-labeling should be standardized and clearly communicated to improve consumer understanding and reduce purchase uncertainty.

Fourth, digital platforms provide valuable opportunities for educating consumers regarding environmental benefits. Social media campaigns, sustainability storytelling, and interactive educational content can significantly enhance consumer engagement.

Finally, policymakers should encourage environmentally responsible consumption through awareness campaigns, certification standards, incentives for sustainable production, and stronger regulations against misleading environmental claims.

12. Future Research Directions

The systematic review identifies several promising avenues for future research.

- Conduct empirical studies using primary data to validate the proposed conceptual framework.
- Compare green purchasing behaviour across generations (Generation Z, Millennials, and Generation Alpha).
- Examine the influence of artificial intelligence and personalized digital marketing on sustainable consumption.
- Investigate the moderating effects of income, education, environmental knowledge, and cultural differences.
- Explore longitudinal changes in consumer attitudes toward eco-friendly FMCG products.
- Assess the effectiveness of green marketing strategies in rural and semi-urban markets.
- Evaluate the impact of emerging technologies such as blockchain for enhancing supply-chain transparency and consumer trust.

13. Conclusion

- Environmental sustainability has become an essential strategic priority within the global FMCG industry. Consumers increasingly expect organizations to demonstrate genuine environmental responsibility through sustainable production, eco-friendly packaging, transparent communication, and ethical business practices.
- This systematic literature review examined recent evidence regarding the effectiveness of green marketing on consumer buying behaviour. The review confirms that green advertising, eco-labeling, sustainable packaging, green brand image, environmental awareness, and consumer trust positively influence consumers' willingness to purchase environmentally friendly FMCG products.
- Among these dimensions, consumer trust and green brand image consistently emerged as the strongest predictors of sustainable purchasing behaviour. The findings also reveal that price sensitivity, product availability, and greenwashing continue to hinder the effectiveness of green marketing initiatives.
- The review contributes to both theory and practice by integrating fragmented evidence into a comprehensive framework explaining sustainable consumer behaviour. For practitioners, the findings emphasize the importance of authentic sustainability practices rather than superficial environmental claims. For researchers, the review identifies several opportunities for empirical investigation, particularly within developing economies.
- Overall, green marketing represents not merely a promotional strategy but a comprehensive organizational philosophy capable of creating long-term value for businesses, consumers, and society.

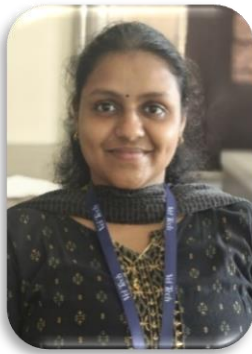
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